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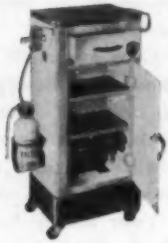

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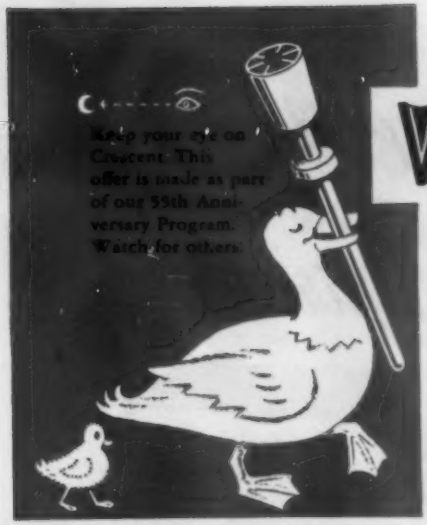

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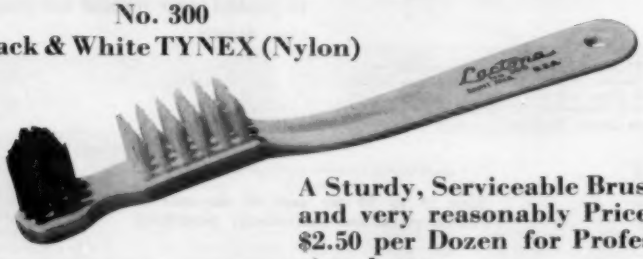

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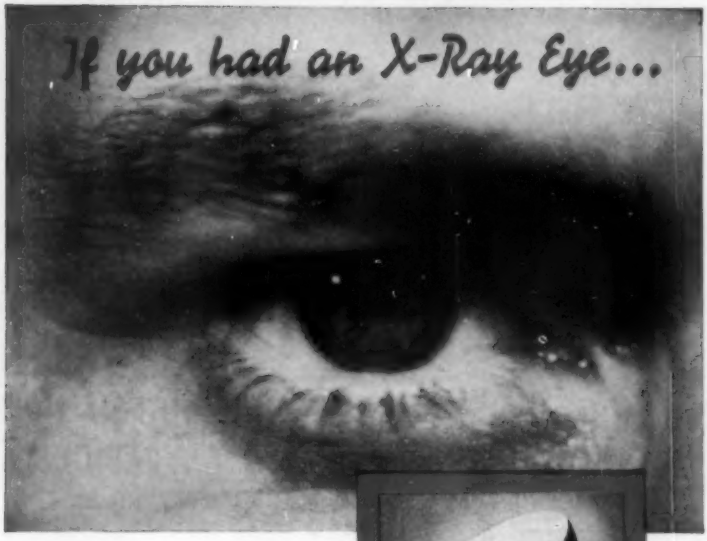

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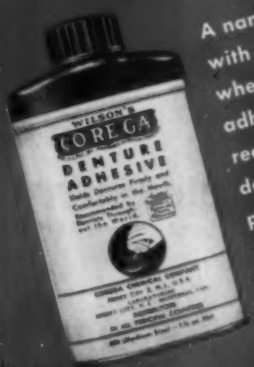

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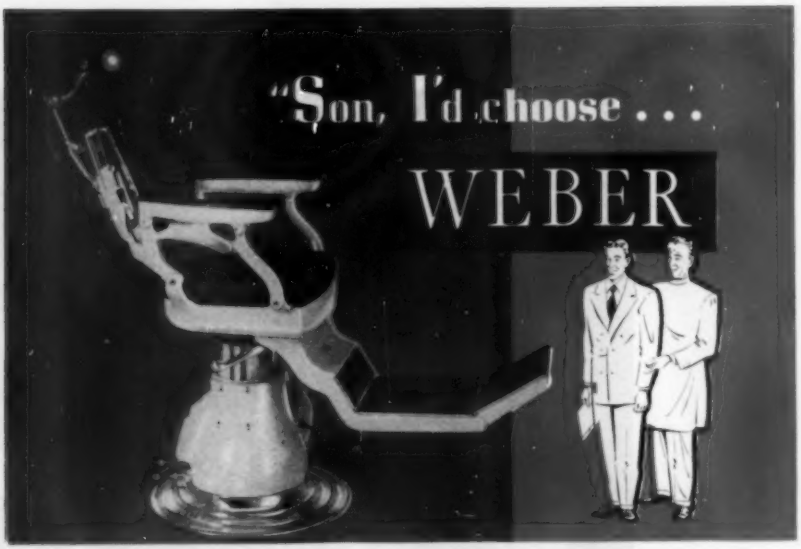

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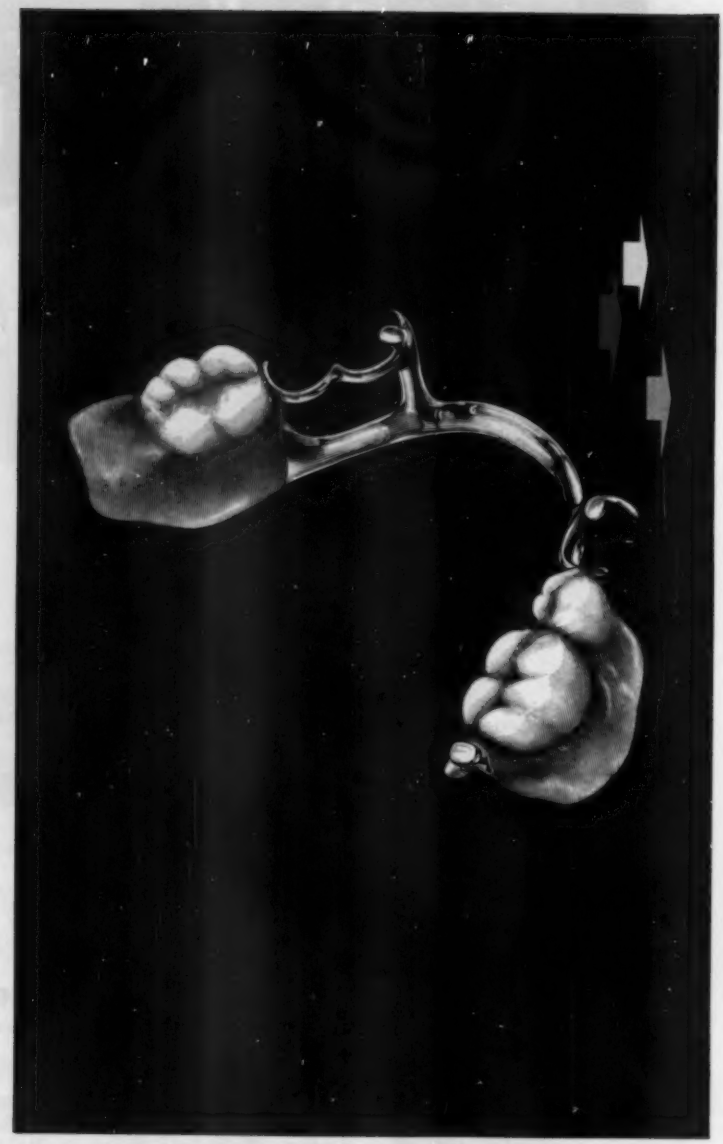

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Experimental caries in germfree rats inoculated with enterococci

Frank J. Orland, D.D.S., Ph.D.; J. Roy Blayney,† D.D.S., M.S.; R. Wendell Harrison,‡ Ph.D., Sc.D., Chicago; James A. Reyniers,§ M.S.; Philip C. Trexler,‖ M.S.; Robert F. Ervin,‡‡ M.S.; Helmut A. Gordon,** M.D., and Morris Wagner,†† M.S., Notre Dame, Ind.*

Full comprehension of the pathogenesis of tooth decay has been precluded largely by the constant presence of microorganisms around the teeth, regardless of whether these masticatory structures were completely intact and therefore normal, or whether partly or completely deteriorated by caries.

Since the earliest days of bacteriological studies it has been considered plausible that the simple microbic forms of life found in the mouth might be related in some way to dental decay.

REVIEW OF LITERATURE

As long ago as 1873, Leber and Rottenstein[1] described microorganisms in carious dentin. A few years later Underwood and Milles[2] reported that sections of decayed dentin had micrococci, oval and rod-shaped bacteria. In the superficial layers they found many such micro-

This study was aided by contracts between Office of Naval Research and University of Chicago (NR:N6 ori-20) and the Office of Naval Research and University of Notre Dame (NR: 131-167).

*Director, Zoller Memorial Dental Clinic; associate professor of dental surgery, department of microbiology, University of Chicago.

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††Associate research professor of bacteriology, Lobund Institute for Research in the Life Sciences, University of Notre Dame.

organisms, but in the deeper areas they were observed only sporadically. This led them to conclude that caries was absolutely dependent on the presence and proliferation of these bacteria. A few years later, Miller[3] was able to demonstrate the presence of cocci and leptothrix, as he called them, within the tubules of decayed dentin. In 1883 he began formulating his concept of dental caries,[4] and in his larger publication[5] Miller consummated his chemicoparasitic views of caries and set forth the culturing methods by which he had isolated 22 different microbic forms from the human mouth.

Goadby[6] described acid-producing organisms in the mouth which he termed *Bacillus necrodentalis;* these he concluded played a role in decalcification of enamel and dentin. Later however, he changed his views somewhat, stating that certain streptococci were the active cause of caries.[7] In some of these views Goadby was supported later on by the work of Hartzell and Henrici[8] who stated that the viridans type of streptococcus was found uniformly present in all advancing borders of caries and, because of their penetrating and necrotizing characteristics, claimed a leading role for this bacterial form in the decay process.

McIntosh, James, and Lazarus-Barlow[9] were concerned with microorganisms that were capable of lowering the pH to the degree that the enamel was softened. From carious dentin they isolated bacteria they called *Bacillus acidophilus odontolyticus.* About the same time Clarke[10] isolated a streptococcus from teeth found to be in the early stages of decay. He called the bacterium *Streptococcus mutans* and found it to be as acidogenic though not as aciduric as the bacillary forms described by McIntosh.

In 1925 Bunting and Palmerlee[11] reported finding microorganisms in every initial lesion of caries that were similar to those described by McIntosh. These they termed *Bacillus acidophilus.* Bunting,[12] who represented their general viewpoint, expressed the opinion that dental caries is a truly infective disease with *B. acidophilus* (later termed *Lactobacillus acidophilus*) as a specific etiologic factor responsible for the initial stages at least.

A study by Tucker[13] on the relation of aciduric and acidogenic microorganisms to dental caries led him to conclude that *L. acidophilus* was not an obligate producer of caries. Tunnicliff and Hammond[14] isolated smooth and rough greening streptococci from carious dentin and from pulps of both intact and carious teeth. They believed these to correspond to the cocci W. D. Miller had described as being present in tubules of carious teeth. In natural caries, they pointed out, cocci usually predominate and often are the only organisms present in tubules. This fact would indicate that the invading organism in dental caries is a coccus, whatever the predisposing factors. Other investigators such as Speidel, Boyd, and

1. Leber, T., and Rottenstein, J. B. Untersuchungen Über die Caries der Zähne, ed. 1. Berlin, A. Hirschwald, 1867.

2. Underwood, A. S., and Milles, W. T. An investigation into the effects of organisms upon the teeth and alveolar portions of the jaws. Trans. Internat. Med. Cong. 7th Session 3:523, 1881.

3. Miller, W. D. Agency of micro-organisms in decay of human teeth. Dental Cosmos. 25:1 Jan. 1883.

4. Miller, W. D. Dental caries. Indep. Pract. 4:260. 1883.

5. Miller, W. D. The microorganisms of the human mouth. Philadelphia, S.S. White Dental Mfg. Co., 1890.

6. Goadby, K. W. The mycology of the mouth. London, Longmans, Green, & Co., 1903.

7. Goadby, K. W. The buccal secretions and dental caries. Brit. Med. J. 2:769 Sept. 1910.

8. Hartzell, T. B., and Henrici, A. T. Pathogenicity of mouth streptococci and their role in the etiology of dental disease. J.N.D.A. 4:477 May 1917.

9. McIntosh, J.; James, W. W., and Lazarus-Barlow, P. An investigation into the etiology of dental caries. I. The nature of the destructive agent and the production of artificial caries. Brit. J. Exptl. Path. 3:138, 1922.

10. Clarke, J. K. On the bacterial factor in the etiology of dental caries. Brit. J. Exptl. Path. 5:141 June 1924.

11. Bunting, R. W., and Palmerlee, F. The role of Bacillus acidophilus in dental caries. J.A.D.A. 12:381 April 1925.

12. Bunting, R. W. Studies on the relation of Bacillus acidophilus to dental caries (Abst.) J. D. Res. 8:222 April 1928.

13. Tucker, W. H. The possible relation of aciduric and acidogenic microorganisms to dental caries. J. Infect. Dis. 51:444 Nov.-Dec. 1932.

14. Tunnicliff, R., and Hammond, C. Smooth and rough greening streptococci in pulps of intact and carious teeth and in carious dentin. J.A.D.A. & D. Cosmos 25:1046 July 1938.

Drain[15] and later Boyd, Wessels, and Cheyne[16] found only a very low degree of correlation between the number of salivary lactobacilli and caries activity.

In experimental studies, Harrison[17] observed streptococci to predominate on the surfaces of noncarious rat molars, about half the strains being acidogenic. In rats with carious lesions, the surface flora consisted primarily of lactobacilli.[18] Microorganisms isolated from the deeper carious cavities were mainly acidogenic streptococci.[19] In view of this, he suggested that there was an apparent relationship of lactobacilli with initial caries and of streptococci with more advanced lesions of the dentin.

Bibby, Volker and Van Kesteren[20] estimated lactobacilli make up less than 0.1 per cent of the strongly acidogenic organisms of the mouth and, since streptococci are many times more numerous and are more rapid acid formers, that lactobacilli give rise to no more than 0.025 per cent of the acid formed by bacterial action on carbohydrates. On the other hand, in a long-range systematic clinical and laboratory study, Hemmens and confreres[21] isolated and classified 27 different microorganisms from dental plaques but found that of these, only the lactobacilli increased in number as early carious decalcification of enamel became apparent in the children studied.

There also have been a number of rather comprehensive reports dealing in some measure with the intrinsic problem of microbic etiology in caries: Kesel,[22] Enright,[23] Jay,[24] Bibby,[25] Cox,[26] Rosebury,[27] Harrison,[28] Frisbie[29] and Shaw.[30]

There also have been a few laboratory studies dealing with the purely negative aspect of the bacterial role in caries etiology. In each study an effort was made to eliminate either the oral bacteria or their substrate. Frequent introduction of penicillin into the region around the teeth noticeably reduced the caries incidence in groups of animals as reported by McClure and Hewitt[31] and later by Webman, Hill and Kniesner.[32] Other antibiotics such as chlortetracycline, bacitracin, chloramphenicol and streptomycin likewise limited to some measure the development of dental caries in hamsters (Zander, Lisanti and Shiere[33]) and in rats (Stephan and associates[34]). Elimi-

15. Speidel, T. D.; Boyd, J. D., and Drain, C. L. Bacteriologic studies in dental caries. J. D. Res. 18:185 June 1939.

16. Boyd, J. D.; Wessels, K. E., and Cheyne, V. D. The correlation between salivary lactobacillus counts and the rates of progression of dental caries: a statistical evaluation. (Abst.) J. D. Res. 28:641 Dec. 1949.

17. Harrison, R. W. Bacteriological studies on experimental dental caries in the rat. I. Bacterial flora of normal, non-carious teeth. J. Infect. Dis. 67:91 Sept.-Oct. 1940.

18. Harrison, R. W. Bacteriological studies on experimental dental caries in the rat. II. Changes in tooth surface flora associated with development and inhibition of dental caries. J. Infect. Dis. 67:97 Sept.-Oct. 1940.

19. Harrison, R. W. Bacteriological studies on experimental dental caries in the rat. III. Flora of advanced carious lesions. J. Infect. Dis. 67:106 Sept.-Oct. 1940.

20. Bibby, B. G.; Volker, J. F., and Van Kesteren, M. Acid production and tooth decalcification by oral bacteria. J. D. Res. 21:61 Feb. 1942.

21. Hemmens, E. S., and others. The microbic flora of the dental plaque in relation to the beginning of caries. J. D. Res. 25:195 Aug. 1946

22. Kesel, R. G. What do we know about dental caries? (a critical review of recent investigations). J.A.D.A. 19:903 June 1932.

23. Enright, J. J.; Friesell, H. E., and Trescher, M. O. Studies of the cause and nature of dental caries. J. D. Res. 12:759 Oct. 1932.

24. Jay, P. Bacteriologic and immunologic changes in dental caries. S. M. Gordon, editor. Dental science and dental art. Philadelphia, Lea & Febiger, 1938, p. 348.

25. Bibby, B. G. The bacteriology of dental caries. In Dental caries: Symposium of three papers. Philadelphia, University of Pennsylvania Press, 1941, p. 27.

26. Cox, Gerald J. A critique of the etiology of dental caries. Vitamins and Hormones, vol. 2. R. S. Harris, and K. V. Thimann, editors. New York, Academic Press, Inc., 1944, p. 255.

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30. Shaw, J. H. Modern concept of the etiology of dental caries: the acidogenic theory. Internat. D. J. 1:48 Dec. 1950.

31. McClure, F. J., and Hewitt, W. L. Relation of penicillin to induced rat dental caries and oral L. acidophilus. J. D. Res. 25:441 Dec. 1946.

32. Webman, H.; Hill, T. J., and Kniesner, A. H. The effect of penicillin on dental caries in rats fed on a coarse corn diet. J. D. Res. 28:258 June 1949.

33. Zander, H. A.; Lisanti, V. F., and Shiere, F. R. Validity of hamster studies in caries control. J. D. Res. 30:139 Feb. 1951.

34. Stephan, R. M., and others. The comparative effects of penicillin, bacitracin, chloromycetin, aureomycin and streptomycin on experimental dental caries and on certain oral bacteria in the rat. J. D. Res. 31:421 June 1952.

Table 1 • Composition of cariogenic diet

Rice (15 to 60 mesh size)	600 Gm.
Casein (vitamin free)	200 Gm.
Cellophane (1 mm. in diam.)	30 Gm.
Salts (fluoride free)	50 Gm.
Fat (hydrogenated vegetable oil)	50 Gm.
Yeast extract	20 Gm.
Liver powder (pork)	20 Gm.
Corn oil	16 Gm.
Corn starch	5 Gm.
Vitamin A	8,000 IU
7-dehydrocholesterol (irradiated)	1,000 IU
Ascorbic acid	2,000 mg.
α, β, γ tocopherol	1,500 mg.
2-me-1, 4 naphthoquinone	100 mg.
Thiamin Cl, HCl	60 mg.
Riboflavin	30 mg.
Pyridoxine HCl	20 mg.
Ca pantothenate	300 mg.
Nicotinamide	50 mg.
Choline	2,000 mg.
Inositol	1,000 mg.
p-aminobenzoic acid	50 mg.
Biotin	1 mg.
Folic acid	10 mg.
Nicotinic acid	50 mg.
Pyridoxamine 2HCl	4 mg.
5% glucose in distilled water	(ad libitum)

nating food substrate from the mouth by stomach tube feeding of rats, thus presumably depriving oral microorganisms of their essential nutrients, resulted in the complete absence of caries as reported by Kite, Shaw and Sognnaes.[35] The Orland and Reyniers[36] groups studied rats that had ingested a sterile cariogenic diet but had lived in an environment completely free of all microorganisms, and they found no carious lesions even on a microscopic level.

PURPOSE

The object of the current series of experiments is to determine which microorganism(s) might be capable of producing typical carious lesions in the molar teeth of rats. Because of the apparent association of lactic acid bacteria to the caries process, our earlier studies were to be concerned with lactobacilli and enterococci, respectively. Experiments with lactobacilli are under way at present. In the particular study being reported here, certain aspects of the role of enterococci in experimental caries are presented; more critical experiments with these same bacteria are contemplated in the future.

METHODS AND EQUIPMENT

All animals used in this study were from the Lobund colony of white rats. Caries susceptibility was found to be almost 100 per cent when the animals from this colony were fed the usual caries-producing diet for 150 days beyond weaning. (The terms "caries-producing" or "cariogenic" diet, as used in this paper, mean that this particular diet can induce carious lesions in the molars of rats having the usual complex bacterial flora. However, in animals completely free of all microorganisms although ingesting the same "cariogenic" diet, no caries could be expected.)

Dietary Regimen • The diet used in all experiments was similar to that reported in an earlier publication,[36] except that glucose was substituted for sucrose. Composition of this diet, L-128, is listed in Table 1. The solid portion as well as the sugar water was always steam sterilized at 17 pounds for 25 minutes. Average fluoride content of the diet was 2.12 ppm, an amount insufficient to affect caries incidence.

Germfree Apparatus and Animals • Animals in the experimental study were housed throughout their entire lives in sealed germfree rearing units (Fig. 1) which have been developed and described

35. Kite, O. W.; Shaw, J. H., and Sognnaes, R. F. The prevention of experimental tooth decay by tube-feeding. J. Nutrition 42:89 Sept. 1950.

36. Orland, F. J., and others. Use of the germfree animal technic in the study of experimental dental caries. I. Basic observations on rats reared free of all microorganisms. J. D. Res. 33:147 April 1954.

by Reyniers and associates.[37] (The single term, "germfree," denotes the special set of conditions that may exist within the animal rearing unit and in which all tests fail to demonstrate the presence of microbic life.) Within these bacteriological barriers, hereafter referred to as the Reyniers germfree (RGF) units, the rats, comprising two experimental groups, were born naturally from germfree dams. Since there has become available a colony of animals free of demonstrable microorganisms, birth by cesarean section was no longer necessary as a means of obtaining germfree rats for the study of dental caries. The germfree animals used were descended through several generations from cesarean-born hand-fed germfree rats.[37]

Bacterial Inoculation of Animals • At the age of 31 days, the first group of germfree rats was inoculated orally with a culture of enterococcus and also with a culture of a proteolytic bacillus. The second group of rats (started nine months later) by accident harbored only an anaerobic, pleomorphic bacterium, extremely difficult to isolate and cultivate. This latter group was inoculated orally at the age of 26 days with the same enterococcus culture used in the first group.

Inoculation was accomplished as follows: a pure culture of the organism was inoculated into a glass ampule of sterile skim milk and incubated at the temperature and time necessary to obtain good growth. The ampule was then hermetically flame-sealed, the exterior thoroughly cleansed by detergent, rinsed in distilled water, and finally totally immersed in 2 per cent mercuric chloride solution. The ampule-in-germicide was returned to the incubator for a period of 1 to 4 hours while preparations for passage into the germfree unit were completed. Final passage into the RGF unit was through a specially designed germicidal (aqueous 2 per cent mercuric chloride) trap.[38]

Fig. 1 • Reyniers germfree units used to house experimental animals

Inside the cage, the ampule was opened and a cotton swab, dipped in the culture, was touched to the mouth of each rat. The experiment was then completed using the same technic as was used for the earlier germfree experiments.[36] Animals either germfree or inoculated in this manner with a single, known bacterium or with two or more known bacteria will be referred to in this paper as gnotobiotic animals. (With the use of new technics, appropriate new terms are sometimes necessary for clarity in communication. The basic concept of "germfreeness" calls

37. Reyniers, J. A.; Trexler, P. C., and Ervin, R. F. Rearing germ-free Albino rats, in Lobund reports no. 1. Notre Dame, University Press, 1946.

38. Reyniers, J. A., and others. Figure 13, in Lobund reports no. 2. Notre Dame, University Press, 1949, p. 43. Also modifications cited in Lobund reports no. 3. Notre Dame, University Press. (In press).

for new terms as has been discussed by Reyniers and co-workers.[39] The Greek-derived term, "gnotobiotic," has reference to "known" life. Thus, the term "gnotobiote" refers to an organism which is grown by itself or in association with known kinds of organisms.)

Frequent and thorough bacteriologic examinations were made on oral, fecal and other specimens in order to follow the distribution and establishment of the one or more intentionally introduced organisms as well as to search for possible accidental unwanted contamination during the experimental run. None was found. The bacteriologic methods were essentially those described earlier by the Orland and Reyniers groups.[36]

Selection of Bacteria • Which microorganisms should be tested in otherwise germfree animals (gnotobiotes) has been a provocative question. As already discussed, the literature is replete with reports of different bacteria that have the potential for caries-productivity. Such information usually has been accrued through observations made by (1) isolating bacterial forms directly from carious teeth; (2) determining *in vitro* the acidogenic or proteolytic properties of these bacteria, and (3) learning whether these bacteria could decalcify enamel or produce carieslike lesions in extracted teeth *in vitro*.

In the selection of bacteria to be tested for their cariogenicity in gnotobiotic animals, a similar sequence of observation was deemed essential. Carious molar teeth from conventional rats were removed from the mandible and then triturated with a sterile pestle and mortar containing sterile broth. From this source, various media were inoculated and incubated under both aerobic and anaerobic conditions. Microorganisms isolated in this manner were studied morphologically, physiologically and antigenically. By this means certain intrinsic microbial attributes could be revealed as constituting a caries-initiating or caries-promoting potentiality.

In the final *in vitro* studies, a sterilized aqueous suspension of the cariogenic rat diet itself was used as a substrate for the test microorganisms. In the presence of the diet substrate, microbial action was registered on a dissected quadrant of sterile rat molars removed from an abiotic young germfree animal. Caries initiation, with or without continuation of microscopic lesions, as seen in ground or decalcified sections, was the final *in vitro* determinant before the bacterium was prepared for oral inoculation of germfree animals in the RGF unit. Among other bacteria, several strains of enterococci seemed to exhibit potential cariogenic attributes. One of these, that resembled *Streptococcus liquefaciens,* was inoculated into germfree rats in a preliminary study. Somewhat atypical, carieslike lesions developed in the animals' molar teeth. Another strain, more closely resembling *Streptococcus fecalis* was selected for inoculation of all test animals in the present study. The colonial and cellular morphology of this microorganism is shown in Figure 2. In one group of gnotobiotic test rats, an alcaligeneslike bacterium was also inoculated because its proteolytic propertics in conjunction with the attributes of the enterococcus seemed to accentuate the *in vitro* lesions observed.

Tissue Preparation • At the end of the experimental period, the rats were taken out of their isolation unit and rendered abiotic by ether. Tissues of the whole body, including blood and saliva collected ante mortem, were observed carefully and evaluated. The rat's head was bisected at the midsagittal plane, fixed in neutral Formalin and stored in 70 per cent ethanol. Roentgenograms were taken

39. Reyniers, J. A., and others. The need for a unified terminology in germ-free life studies, Lobund reports no. 2. Notre Dame, University Press, 1949, p. 160.

of each half of the head. The resultant cephalo-roentgenograms were used for gross caries observation and in determining the several craniometric distances for growth evaluation. These cranial distances were from the occipital to the nasal point (O-N) and from the most superior to the most inferior skeletal registration when measured along a perpendicular erected on O-N at the mesial surface of the mandibular first molar (C-M). Femurs of the animals were measured, roentgenograms taken and analyses made for fluorides.

Caries Evaluation • In the earlier monographic report,[36] the incidence of dental caries was evaluated in several quantitative ways including micrometric determinations of ground and decalcified sections. Up to the present time, only a purely qualitative analysis of caries incidence has been conducted on the molar teeth of all the rats in this study.

RESULTS OF STUDY

Comparisons were made of weight, femur length, craniometric distances, sex dis-

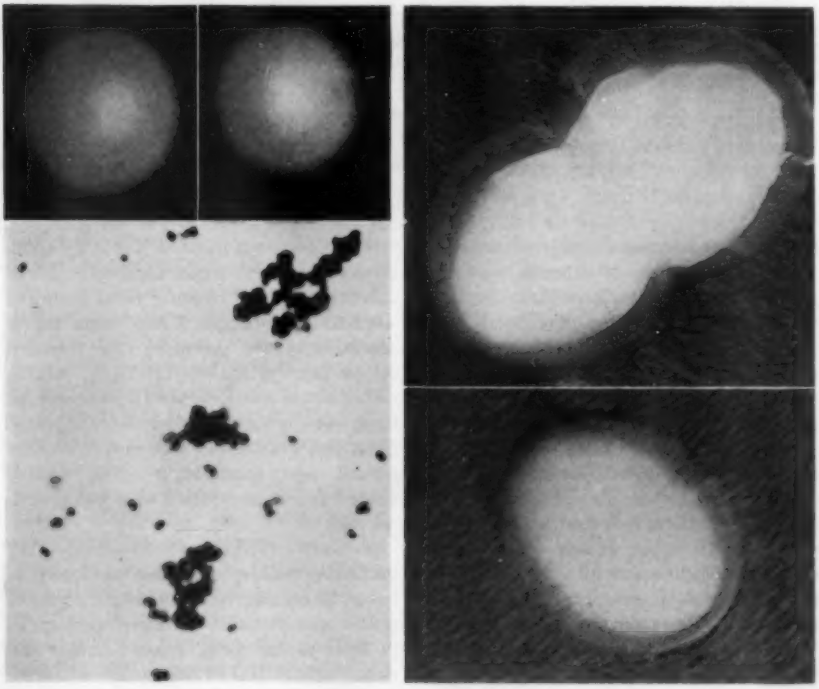


Fig. 2 • Left, above: Enlarged view of enterococcus colonies showing smooth, glistening, entirely edged form. Below: Cells from such colonies at magnification ×1,000 are gram positive, coccoid in shape, and frequently are in pairs or chains. Right, above and below: Electron micrograph of coccus which was overwhelmingly predominant form of microbic life existing with gnotobiotic rats in rearing units. Enterococcus cells (magnification ×30,000) usually appear to be ovoid and often in pairs. In the living state these cells are approximately 1 micron in diameter

Table 2 • Comparative measurements on rats at necropsy

Group identification	No. of rats	Sex	Days on expt'l diet	Bacterial environment	Molar dental caries	Craniometric distances in mm. O-N	Craniometric distances in mm. C-M	Femur length in mm.	Animal weight in Gm.
39D3-1AI	5	♂	150	enterococcus and proteolytic bacillus	+	47.6	22.9	35.7	404
39D5-1AI	4	♂	150	enterococcus and pleomorphic bacterium	+	46.4	23.0	35.9	395
	4	♀				42.2	21.3	30.7	254
25J1-1	3	♂	173	germfree	0	45.9	22.3	no data	313
	6	♀	205			44.1	21.1		219
39D4-1AI	1	♂	151	pleomorphic bacterium	0	48.7	24.0	36.9	480
	4	♀				43.8	21.6	31.0	265.8
39D3-1 AIB, 39D4-1 AIB, 39D5-1 AIB	4	♂	150	artificially acquired, complex	+	47.2	23.0	35.8	468.8
	9	♀				42.3	21.8	31.1	253.3
39D3-1 B, (39D4-1 B, 39D5-1 B)	11	♂	150	uncontrolled, complex	+	45.9	22.4	35.9	384.5
	5	♀				42.0	21.5	31.3	223.8

tribution and femur fluoride content for the various groups of animals included in the study. Table 2 presents average figures for each group of rats. It also indicates the absolute bacterial environment surrounding the animals externally as well as internally, at least as far as the oral-gastrointestinal tract is concerned. In addition to these data, Table 2 also shows the caries experience of each group of rats.

From the data collected it was found that body weights, femur lengths and craniometric distances all were essentially normal for each sex, regardless of the kind of bacterial environment with which the animals had been associated. A low femur fluoride content, ranging from 26.2 to 52.3 ppm for the various groups of rats, resulted from the ingestion of a diet low in fluorides. There is no evidence that this minimal amount of fluoride would have any effect on the development of dental caries.

The six groups listed in Table 2 varied, however, in their caries incidence. Those animals (25J1-1) having been germfree were also caries-free. These were representative of the germfree rats reported on earlier.[86] Rats (39D4-1AI), having only a single contaminant (a pleomorphic form which could never be cultivated from the oral cavity but only from the cecum and sporadically from freshly voided feces) also failed to develop dental caries.

By contrast, eight animals (39D5-1AI) harboring only the elusive pleomorphic bacterial contaminant and the inoculated enterococcus strain, all developed caries in their molar teeth. Likewise, five animals (39D3-1AI) originally germfree but inoculated with the same enterococcus, as well as with a proteolytic nonsporulating bacillus also were found to have developed dental caries.

Another composite group (39D3-1 AIB, 39D4-1 AIB, 39D5-1 AIB) made

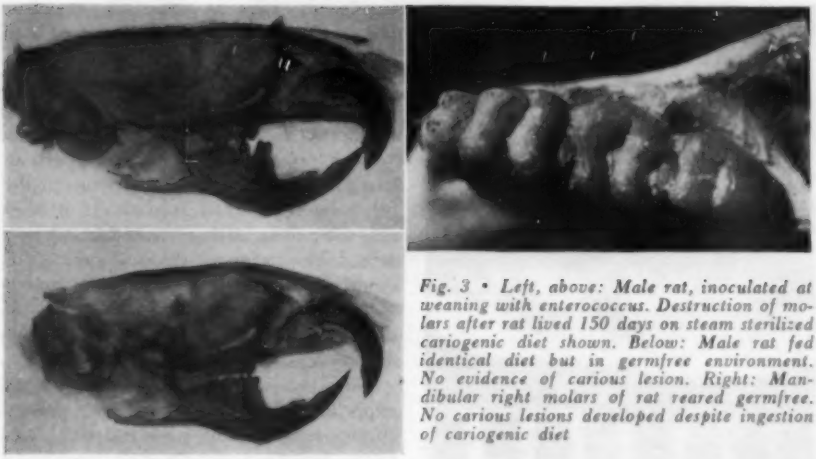


Fig. 3 • Left, above: Male rat, inoculated at weaning with enterococcus. Destruction of molars after rat lived 150 days on steam sterilized cariogenic diet shown. Below: Male rat fed identical diet but in germfree environment. No evidence of carious lesion. Right: Mandibular right molars of rat reared germfree. No carious lesions developed despite ingestion of cariogenic diet

up of rats which were respective littermates of the gnotobiotic animals just mentioned, at first lived in the Reyniers germfree units with their siblings. Shortly after inoculation with the test strains of bacteria, however, they were taken outside the isolation units to the conventional animal colony to acquire a "normal" microbic flora by such artificial means. This they did, and the developing flora was studied and found to become complex and essentially not unlike the flora of conventional animals. Dental caries resulted during their 150 days on the same cariogenic diet.

A final group of rats (39D3-1B and 39D4-1B, 39D5-1B) was composed of conventional control animals having an uncontrolled, complex bacterial flora in their oral cavities. They were living concurrently with the other groups and were used to ascertain whether the sterilized, cariogenic diet ingested by all animals was, in fact, caries-productive during the decisive test period.

Thus there are, in essence, three kinds of findings observed in the animal groups listed in Table 2. Considered now in reverse order, (1) there were all the animals harboring a complex bacterial flora which developed caries. These comprise a positive control collection of rats. (2) There were those which were essentially free of all microorganisms, at least as far as the oral cavity was concerned. No caries occurred here; these are the negative control animals. Finally, (3) there were the test animals inoculated with an enterococcus in the presence of one other, less frequently found, bacterium. In this instance rather typical carious lesions developed.

Photographic as well as roentgenographic evidence of the findings in these three aggregates of animal groups is shown in Figures 3 to 8.

DISCUSSION

It becomes apparent from the foregoing review of earlier observations which have had either a direct or indirect bearing on the findings in this report, that caries of the teeth must be primarily a bacterial disease. With procedures which quantitatively or qualitatively limit or alter the oral microbial flora to a greater or lesser extent, that is, in an environment such

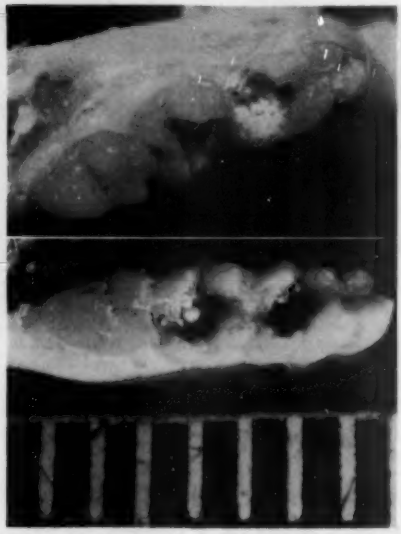


Fig. 4 • Molars from rats inoculated with enterococcus. Above: First and second mandibular left molars show medium-sized carious cavities with food debris in situ. Below: Deep carious lesions surrounded by quasi-intact molar cusps in mandibular left quadrant. To illustrate diminutive dimensions of molars, millimeter scale is included

as occurs when penicillin or the other antibacterial agents are applied directly to the mouth or tooth surfaces, a reduction, though not a complete cessation of caries has resulted. Furthermore, with the complete absence of microorganisms as in germfree rats, no caries has resulted despite the ingestion of a highly cariogenic diet for a long period of time. By inductive reasoning, though complete direct experimental evidence was lacking, it has been possible to state that caries is a disease requiring the presence of living microorganisms (or, to be precise, at least the requisite bacterial enzymes on a submicroscopic level).

In the present study with gnotobiotic rats, direct evidence has been presented that one bacterial strain (or possibly one in remote association with another) has produced caries in otherwise germfree rats. In these animals, inoculated with an enterococcus, it must be noted that no lactobacilli were present in the system. The only other bacterial cells, besides the enterococcus, in this host-microbe system were a proteolytic rod in one group of rats and a pleomorphic bacterium in the other later group of animals. In neither case were these latter microorganisms ever found consistently in the oral cavity, nor could they be seen in the microtome-cut sections stained for bacteria which is in direct contrast to the ubiquitous enterococci.

Nevertheless, despite the rather strong experimental evidence in these animal studies that typical carious lesions can be produced in the absence of lactobacilli, it should be pointed out that enterococci are lactic acid bacteria. Cells belonging to the enterococcus group are generically streptococci, usually of the (gamma) nonhemolytic type. They can produce lactic acid from glucose much as certain of the lactobacilli can. Specifically the enterococcus, which predominated and always could be isolated consistently from the rats' oral cavity and teeth, was a strain closely resembling the species *Streptococcus fecalis*.

There have been a few sporadic reports in the research literature that bacteria of the enterococcus type are associated with the oral cavity and possibly with the caries process itself. In 1933, Wohlfiel[40] entertained the view that enterococci may have a role in caries. More specifically, Tefft[41] has stated that *S. fecalis* and *S. lactis* are sufficiently acidogenic to act as decalcifying agents in dental caries. A few years ago Williams[42] reported finding

40. Wohlfiel, T. Der Enterokokken als Krankheitserreger und Saprophyten. Arch. f. Hyg. 111:11, 1933.

41. Tefft, H. I. Possible significance of streptococci in the production of dental caries. (Abst.). J. D. Res. 21:318 June 1942.

42. Williams, N. B., and Judson, M. A. The frequency of occurrence of enterococci in human saliva. (Abst.) Bact. Proc. 49th General Meeting, S.A.B. May 1949, p. 77.

four species of enterococci in the human mouth. He later discussed the possible participation of enterococci in dental caries.[43] Wakeman and associates[44] obtained quantitative bacterial counts in teeth of the cotton rat which indicated that enterococci may have a role in the initiation or continuation of the caries process. By extracting, weighing and grinding the rats' molar teeth and then making serial dilution counts, these investigators isolated both lactobacilli and enterococci from the carious teeth. The enterococci were found to be more numerous than lactobacilli in these cultures. Although not classified precisely as to species, the enterococci encountered were stated to be strongly proteolytic and to resemble *Streptococcus liquefaciens.* Hemmens, Blayney and Harrison[45] in their study of bacterial plaques from carious and noncarious teeth reported the frequent occurrence of hemolytic streptococci, nonhemolytic gram positive diplococci, diphtheroids, and anaerobic fusiform bacilli. Lactobacilli and other microbic forms were observed less frequently. Nevertheless, lactobacilli were found most often in plaques from carious

43. Williams, N. B., and others. A study of the simultaneous occurrence of enterococci, lactobacilli, and yeasts, in saliva from human beings. J. D. Res. 29:563 Oct. 1950.

44. Wakeman, E. F., and others. Microorganisms associated with dental caries in the cotton rat. J. D. Res. 27:489 Aug. 1948.

45. Hemmens, E. S.; Blayney, J. R., and Harrison, R. W. The microbic flora of bacterial plaques removed from carious and non-carious dental enamel. J. D. Res. 20:29 Feb. 1941.

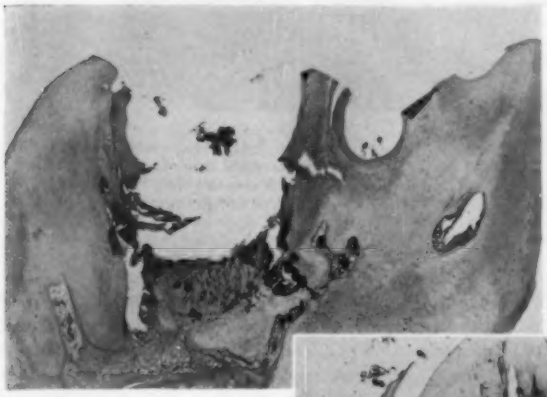


Fig. 5 • Left: Carious destruction of central sulcus of mandibular left first molar. Animal belongs to group wherein the enterococcus overwhelmingly predominated over proteolytic nonsporulating bacillus. Both bacteria were inoculated in germfree rats' environment 150 days earlier

Right: Extensive disintegration by caries of second molar. This tooth was contiguous to first molar shown above. Note dentin fragmentation and pulp involvement

Fig. 6 • Magnification of carious dentin in central region of molar shown in Figure 5. Enterococci can be seen in dentinal tubules and spaces as individual cells and in microcolonies. No other bacterial forms are visible in Brown-Brenn differentially stained section.

regions, while streptococci were found most frequently in those from noncarious regions. This same group of investigators[21] further reported on the changing flora of the dental plaque wherein they identified 27 varieties of microorganisms but showed that only the lactobacilli increased in incidence with the appearance of the initial stages of carious decalcification of the enamel.

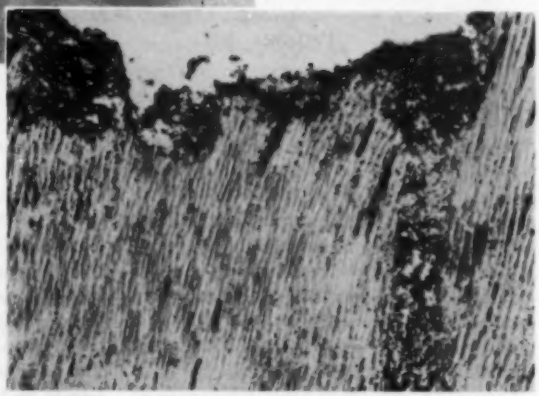
It was observed that this particular strain of enterococcus inoculated into the germfree environment in this study had the capabilities of producing extensive carious lesions in every one of 13 animals which had ingested a highly cariogenic diet. The observation does not preclude the possibility that certain lactobacilli or other bacteria could likewise produce dental caries under similar experimental conditions. This report, nevertheless, establishes the fact that bacteria other than lactobacilli can cause caries under certain experimental situations. This is especially significant, it is believed, from the historical view, inasmuch as lactobacilli have been isolated by so many different research workers[46, 47] under con-

46. American Dental Association, Research Commission. Dental caries, ed. 1. Chicago, American Dental Association, 1939.

47. American Dental Association, Research Commission. Dental caries, ed. 2. Chicago, American Dental Association, 1941.

Fig. 7 • Mandibular right molars of control rat which had been permitted to acquire complex microbic flora by removal from enterococcus-inoculated tank to outside, contaminated environment. Extensive carious destruction is evident in first and second molars

Fig. 8 • Left: Decalcified section of mandibular right first molar. This tooth is from conventional control animal. Relatively small occlusal carious lesion apparent in dentin. Most lesions in this group of rats were more extensive



Right: Greater magnification of central region of molar sulcus shown above. With uncontrolled complex oral microbic flora in rat, a variety of bacterial forms are observable in carious dentin

ditions implicating them as the specific, sole, probable, or possible cause of caries in teeth. It should be re-emphasized that the particular culture used in these studies, as well as all enterococci as a group, belong to the same bacterial family as the lactobacilli, namely, the *Lactobacteriaceae,* since they all have in common the ability to elaborate lactic acid to a greater or lesser extent.

SUMMATION

This report is based on the study of experimental dental caries in which the new biological technic of inoculating otherwise germfree animals with known bacteria was used. Earlier studies had revealed that rats reared entirely free of all bacteria developed no caries despite ingestion of a "cariogenic" diet for five

months. In the present report, two groups, totaling 13 rats, inoculated with known bacterial cells in which an enterococcus was the predominating microbic form of life, all developed carious lesions in their molar teeth. These animals were fed the same standard diet that was fed to all conventional control rats having an unknown, complex bacterial flora. These latter rats regularly developed carious cavities during the 150 day test period.

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Oral aspects of excessive fluorides in a water supply

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A ten year (1943-1953) study of the systemic effects of human ingestion of excessive fluorides in a water supply has been reported recently.[1] Bartlett, Texas, with a water supply containing approximately 8.0 ppm fluoride (F) was the study area and Cameron, Texas, with about 0.4 ppm fluoride (F) in its water system was the control area. In 1943, residents of Bartlett and Cameron were selected for study if they had lived in their respective areas for a minimum of 15 years and had been relatively continuous consumers of the municipal water supplies. The subjects were not required to have been born in Bartlett or Cameron or to have resided in either town during their tooth formative periods. Each subject received a medical and dental examination.

In 1953, all of the available original subjects were re-examined. The physical examinations included a routine oral examination by a physician; two-thirds of the subjects were also examined by a dentist. At the end of the study period the subjects, on the average, had been living in Bartlett for 37 years and in Cameron 38 years. Over 75 per cent of them began residence in their respective communities after the age of 6 and 60 per cent after the age of 14. The majority have continued to live in their respective communities since the initial examination in 1943.

The dental examination was but one phase of the comprehensive medical survey of the subjects, and its purpose was

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1. Leone, N. C., and others. Medical aspects of excessive fluorides in a water supply. Pub. Health Rep. 69:925 Oct. 1954.

Table 1 • Distribution of participants by locality, age, sex, and number of continuous residents, based on 1953 ages

Age group, years	Mean age, years	No. of persons			Continuous residents*	
		Male	Female	Total	No.	Per cent
			Bartlett			
Under 45	35.7	1	7	8	7	88
45-54	48.7	6	15	21	4	19
55-64	60.6	10	19	29	0	0
65 and over	70.6	6	12	18	0	0
All ages	57.1	23	53	76	11	15
			Cameron			
Under 45	36.7	2	7	9	5	56
45-54	49.9	9	18	27	11	41
55-64	59.5	13	17	30	3	10
65 and over	68.9	4	10	14	1	7
All ages	55.3	28	52	80	20	25

*Participants born and residing in respective localities during period of tooth formation.

to determine by clinical and roentgenographic methods if excessive fluoride ingestion over a long period of time was associated with changes in the oral tissues. Only the dental observations for those participants who had been examined in 1943 and again in 1953 by a dental officer are presented in this paper.

METHODS

In 1943, 116 persons in Bartlett and 121 in Cameron were examined for dental caries experience, dental fluorosis and periodontal disease. In 1953, 76 of the original Bartlett subjects and 80 of the initial Cameron group were re-examined dentally; these people constituted essentially all of the resident group. The sex ratios of the subjects were approximately the same in the two study groups (Table 1). In both examinations mouth mirrors and explorers and artificial illumination were used; dental caries experience was expressed by the DMF[2] rate and dental fluorosis by Dean's index.[3] In 1953, gingivitis was assessed by the PMA index.[4] In addition, 14 periapical roentgenograms were taken of all examined subjects except two persons in each group. These films were evaluated for alveolar bone loss according to the method of Stahl, Wisan and Miller[5] by four dentists independently (E. R. Zimmermann, E. M. Benjamin and H. R. Stanley, Jr., of Bethesda, Md., and B. A. Williamowsky of Silver Spring, Md.). The classification of alveolar bone resorption was based on the height of alveolar crests in relation to adjacent roots. Alveolar bone loss was designated as "mild" when the majority of crest-root relationships seen on roentgenograms showed that resorption was limited to the coronal quarter of the root length, "moderate" when resorption was within the second quarter of the root length, and "severe" when resorption was within the apical half of the root length. Resorption was also classified as "horizontal" or "vertical" according to the predominant type.

A method for classifying calculus by degree of severity was devised for the 1953 examination. Visually detected supragingival calculus was considered

2. Klein, H.; Palmer, C., and Knutson, J. W. Studies on dental caries: dental status and dental needs of elementary school children. Pub. Health Rep. 53:751 May 13, 1938.

3. Dean, H. T. Investigation of physiological effects by the epidemiological method. In Fluorine and dental health, Moulton, F. R., editor. Lancaster, Pa., Science Press, 1942, p. 26-28.

4. Massler, M., and Savara, B. Relation of gingivitis to dental caries and malocclusion in children 14 to 17 years of age. J. Periodont. 22:87 April 1951.

5. Stahl, S.; Wisan, J., and Miller, S. C. Influence of systemic diseases on alveolar bone. J.A.D.A. 45:277 Sept. 1952.

"slight" if two or more teeth had a surface deposit less than 1 mm. in vertical height, "moderate" if the accumulation was 1 mm. or more in height, but less than "bridging," and "severe" if two or more teeth were bridged by the accretion. If only infragingival calculus was observed, the deposit was designated as "slight."

OBSERVATIONS

Fluorosis • All persons with fluorosis in Bartlett or Cameron had been residents in a fluoride area during the period of calcification of their permanent teeth. As can be seen in Table 1, however, comparatively few of the Bartlett subjects in this study were born in Bartlett or reared in that community while the permanent teeth were forming. This accounts for the low prevalence of fluorosis in this group. Ten of 45 nonedentulous individuals in Bartlett (22.2 per cent) and 1 of 64 in Cameron (1.6 per cent) had positive signs of fluorosis in 1953. Although different dentists examined the subjects in 1943 and 1953, there was agreement in 91 per cent of the "positive" cases. As would be expected, fluorosis was neither more prevalent nor more severe among the individuals after this ten year period of exposure. Since the fluorosis pattern of these persons had been established during the first eight years of life, they were not "at risk" for fluorosis during the study period.

Decayed, Missing, or Filled Permanent Teeth • Although this investigation was not designed primarily to study the fluoride-dental caries relationship, it did offer useful information on the ten year incidence of caries experience in these two groups of people. The DMF rates of those examined in 1943 and 1953 are presented in Table 2. Bartlett's DMF rate was lower than Cameron's in 1943 but higher in 1953. The latter was due principally to an increased number of missing teeth in Bartlett. At the end of the study period, 47 per cent of the tooth loss in Bartlett and 25 per cent in Cameron was attributed by the individuals themselves to periodontal disease; 5 per cent of the tooth mortality in Bartlett and 1 per cent in Cameron was ascribed to general health considerations, trauma and appearance. If the teeth lost through periodontal disease and causes other than caries were excluded from the 1953 DMF rate, the caries experience of the subjects

Table 2 • Dental caries experience, excluding third molars, of the same Bartlett and Cameron participants examined in 1943 and 1953

Age group, years (by 1953 ages)	No. of persons	DMF rate*		No. of missing teeth attributed to dental disease†			
		1943	1953	1943	1953	diff.	increment/person
Bartlett							
Under 45	8	5.6	10.5	10	11	1	0.1
45-54	21	8.1	13.9	107	214	107	5.1
55-64	29	16.4	19.3	300	430	130	4.5
65 and over	18	19.6	20.6	315	354	39	2.2
All ages	76	13.7	17.2	732	1009	277	3.6
Cameron							
Under 45	9	6.2	10.4	16	25	9	1.0
45-54	27	12.4	14.7	80	124	44	1.6
55-64	30	17.8	19.6	348	399	51	1.7
65 and over	14	14.9	19.5	134	211	77	5.5
All ages	80	14.2	16.9	578	759	181	2.3

*Number of decayed, missing and filled permanent teeth per person.
†Periodontal disease or dental caries.

Table 3 • Amount of gingivitis per person (PMA units) in the nonedentulous Bartlett and Cameron participants

Age group, years	Bartlett							Cameron							Significant difference P=.05
	No. of persons	No. of gingival units affected				Mean units per person	S.E. of the mean	No. of persons	No. of gingival units affected				Mean units per person	S.E. of the mean	
		P	M	A	total				P	M	A	total			
Under 45	7	65	62	23	150	21.43	10.52	9	70	57	21	148	16.44	4.86	no
45-54	15	175	159	35	369	24.60	4.86	26	204	173	50	427	16.42	2.32	no
55-64	15	116	110	31	257	17.13	4.38	19	221	187	90	498	26.21	4.44	no
65 and over	8	87	83	20	190	23.75	5.95	10	127	106	27	260	26.00	4.50	no
All ages	45	443	414	109	966	21.47	2.75	64	622	523	188	1333	20.83	1.92	no

in Bartlett would be 33 per cent lower than was that of the subjects in Cameron.

Periodontal Disease • In 1943, no important differences in the health of the periodontal tissues were observed between the Bartlett and Cameron residents. In 1953, the clinical (Table 3) and roentgenographic (illustration) evaluations of the subjects' periodontal condition show that the amount of gingivitis and alveolar bone resorption did not differ significantly between the two groups. When measured clinically by another quantitative method,[6] the results again were similar.

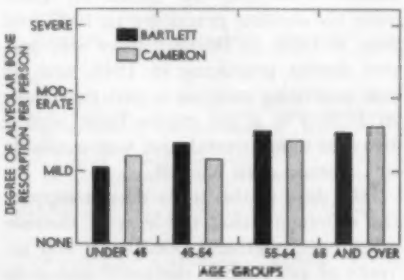
Other Oral Conditions • No important differences in the prevalence of oral tori, leukoplakia, lichen planus, soft tissue color abnormality, calculus, pulp stones, horizontal or vertical alveolar bone resorption, periapical rarefaction, condensing osteitis and dentigerous cysts were found between the Bartlett and Cameron subjects (Table 4). The difference in number of examined persons in this table is due to the exclusion of edentulous individuals or those for whom roentgenograms were not made from the calculations of certain prevalence rates.

DISCUSSION

When the composition of the sample is considered, it is not surprising that Bartlett's DMF rate is similar to that in Cameron. There were comparatively few continuous residents in the Bartlett study group; only 11 of 76 individuals were born in Bartlett or were reared there during the period of tooth formation. Consequently, the relatively low DMF rate of the continuous residents forms only a small part of the total DMF rate in Bartlett.

At the end of the ten year study period, more teeth per person were missing in Bartlett than in Cameron (Table 2), but this difference was not statistically significant. There were more full-mouth extractions in Bartlett than in Cameron. A larger segment of the tooth mortality rate was attributed to periodontal disease and causes other than caries by the Bart-

6. Russell, A. L. Studies in periodontal disease. In preparation.



Degree of alveolar bone resorption per person, by age groups, in the 45 Bartlett and 64 Cameron participants with natural dentitions

Table 4 • Prevalence of certain dental conditions among adults of Bartlett and Cameron, Texas, 1953

	Bartlett			Cameron			
	Number examined	No. with condition	% (rate)	Number examined	No. with condition	% (rate)	Significant difference P=.05
Clinical examination							
1. Calculus	45			64			
a. slight		17	37.8		18	28.1	no
b. moderate		9	20.0		23	35.9	no
c. severe		9	20.0		7	10.9	no
2. Tori palatinus and mandibularis	76	12	15.8	80	20	25.0	no
3. Soft tissue pathology							
a. Leukoplakia	76	1	1.3	80	4	5.0	no
b. Lichen Planus	76	0	0	80	2	2.5	no
c. Color abnormality	76	4	5.3	80	8	10.0	no
Roentgenographic examination							
1. Pulp stones	43	8	18.6	63	15	23.8	no
2. Alveolar bone resorption							
a. Horizontal type	43	41	95.4	63	57	90.5	no
b. Vertical type	43	0	0	63	2	3.2	no
3. Periapical rarefaction	43	4	9.3	63	6	9.5	no
4. Condensing osteitis	74	5	6.8	78	6	7.7	no
5. Dentigerous cyst	74	0	0	78	1	1.3	no

lett subjects than by the Cameron residents. In contrast, however, the clinical examinations in 1943 and in 1953 and the roentgenographic evaluations in 1953 showed similar periodontal conditions in both groups; these observations do not suggest that more teeth were lost in Bartlett because of periodontal disease. A possible explanation of the greater tooth loss in Bartlett is a difference in the availability of dental care and in dental health education. In Cameron, there were six dentists practicing in 1943 and four in 1953. In Bartlett, there was only one dentist practicing in 1943, and he was practicing only on a part time basis in 1953. On a per capita basis, almost twice as much dental care was available in Cameron as in Bartlett.

The data in this study do not support the statements that residents of fluoride areas have a greater prevalence and severity of periodontal disease[7,8] and pulp stones[8] than those of nonfluoride areas. Both clinical and roentgenographic evaluations, performed without reference to each other, indicated that the periodontal health of the Bartlett and Cameron subjects was approximately the same. A statistical comparison of these observations was made, and a positive and linear relationship between them resulted.

Approximately 78 per cent of the Bartlett residents and 75 per cent of the Cameron subjects were found to have calculus. A larger per cent of the Bartlett subjects had an amount classified as "slight" and "severe"; more Cameron residents were found with "moderate" calculus. In general, age and amount of calculus were directly proportional; a greater amount of calculus was observed on the teeth of older subjects.

SUMMARY

1. A ten year (1943-1953) study of two groups of people residing in Bartlett (8.0

7. McCormack, W. J. Domestic water fluoridation. Arch. Pediat. 70:114 April 1953.

8. Dillon, C. Biochemistry of fluorides. D. Digest 59:486 Nov. 1953.

ppm fluoride (F)) and Cameron (0.4 ppm fluoride (F)), Texas, was conducted to determine if the prolonged use of excessive fluorides in a water supply was associated with physiological changes in body tissues. The oral aspects of this study have been presented in this report.

2. One hundred and fifty-six participants, 76 in Bartlett and 80 in Cameron, were examined in 1943 and in 1953 for dental caries experience, gingivitis, dental fluorosis, and other types of oral pathology.

3. As was expected, dental fluorosis was significantly higher in Bartlett than in Cameron. The amount of gingivitis, alveolar bone resorption, dental caries experience, calculus and the prevalence of leukoplakia, lichen planus, soft tissue color abnormality, pulp stones, horizontal and vertical alveolar bone resorption, periapical rarefaction, condensing osteitis, and dentigerous cysts were examined statistically and no significant difference was found between the Bartlett and Cameron residents.

Review of the Bartlett-Cameron survey: a ten year fluoride study

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Long-standing and widespread interest in the effects of fluoride has stimulated a great number of investigators to study fluorides under varying circumstances. The Public Health Service has been one of these investigator groups. It has been particularly interested in the physiological effects of fluoride in water.

The Bartlett-Cameron study reported here combined the methods of clinical, laboratory, and epidemiological research to further knowledge regarding fluorides. It was begun in 1943 by H. Trendley Dean and Francis A. Arnold, Jr., of the Public Health Service, in the towns of Bartlett and Cameron, Texas. Ten years later the same procedures, with a few additions, were repeated by another Public Health Service team. The purpose was to study a population group which had ingested water containing excessive amounts of naturally occurring fluoride over a long period.[1]

Bartlett was selected because the

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1. Leone, Nicholas C. Medical aspects of excessive fluoride in a water supply: a ten year study. In Fluoridation as a public health measure, Shaw, J. H., editor. Washington, D. C., American Association for the Advancement of Science, 1954.

natural fluoride level of the local water supply was one of the highest in the nation—8 ppm fluoride (F)—which is eight times the amount recommended for dental caries prevention. A town with a water supply naturally containing excessive fluoride was selected on the assumption that any association between exposure and physiology might be manifest at a high concentration, particularly after prolonged ingestion. Cameron, comparable in size, location and other characteristics was the control town. Its water supply contained 0.4 ppm of fluoride (F).

Bartlett and Cameron are geographically located on a triangle with Temple, Texas, 135 miles due south of Dallas. Bartlett is 20 miles south of Temple, and Cameron 38 miles southeast of Temple. The two towns are about 25 linear miles apart, but are not connected by a direct road. In 1940 the populations of Bartlett and Cameron were 1,668 and 5,040, and in 1953, 1,706 and 5,272 respectively.

In March 1952 an experimental defluoridation unit was put into operation in Bartlett in an attempt to reduce the fluoride content of the water to 1.0 ppm fluoride (F), a level that provided dental caries protection without producing mottled enamel. Since the installation of the unit, the fluoride content of the water has varied considerably because of necessary mechanical and experimental changes. However, it has remained somewhat above the desired level of 1.0 ppm fluoride (F). By 1953 the Bartlett subjects in the study had ingested fluorides at high levels for many years. Any significant pathological manifestations of prolonged exposure would not be expected to have regressed materially in the 18 months of partial defluoridation.

The 237 individuals who were studied were about evenly divided between the two towns. They were persons who had lived in their respective communities for a minimum of 15 years prior to 1943. The average length of residence, at the end of the study period, was 37 years for the Bartlett group and 38 years for those in Cameron. The subjects' ages ranged from 15 to 68 years at the beginning of the study. All were of the white race.

PROCEDURE

In 1943 a medical-dental team from the Public Health Service examined 116 subjects in Bartlett and 121 in Cameron.

The 1943 group was selected after a preliminary survey that covered approximately every household in Bartlett and every third household in Cameron. An adult member of each household was interviewed and history forms were made out for each household member. On the basis of the data so obtained, a random sample was chosen from those who met the basic requirement—15 years or more of continuous residence prior to 1943.

Ten years later, in 1953, all of the original subjects were accounted for, and all but 10 of the living were re-examined. Approximately 71 per cent of the 237 subjects in the 1943 survey still resided in Bartlett and Cameron. Information on the deceased, another 8 per cent, was obtained from the next of kin, and copies of the death certificates were obtained to establish cause of death. Because of the unusual success in accounting for 79 per cent of the subjects locally, it was deemed practicable to follow up the remaining 21 per cent who had moved from the study areas. As a result, all of the 1943 subjects, living, deceased or "removed" were accounted for in the 1953 study.

Forty-seven subjects had moved away from the two towns in the ten years; two had moved to California, one to Oklahoma, and one to New York City. Forty-three of the "removed" subjects still lived in Texas. Of these, 37 were examined and the data were obtained by the same procedures as used for those who remained in residence.

The ten living persons who were not examined were interviewed by personal

contact, telephone or mail, and a ten year medical and residence history was obtained. None reported acute, chronic, serious or debilitating illnesses.

The data were evaluated for the group as a whole and separately for those who remained in residence. Analysis of the findings for the subjects who remained in continuous residence and for the whole group, including the "removed," showed no important differences; to assure comparability, however, the present report deals only with the resident group.

The 1943 and 1953 procedures were essentially parallel. They included a medical history, physical and dental examination, roentgenograms, blood and urine studies. In the earlier study the physical and dental examinations and the laboratory work were done locally in the respective towns, and the patients were later transported to the Scott and White Clinic in Temple, Texas, for their roentgenographic examination.

The 1953 procedure differed slightly in that the majority of physical and laboratory examinations, as well as the roentgenographic, were done at the Scott and White Clinic by Public Health Service personnel. Blood and urine analyses were done by the Scott and White Clinic technicians, and the chief of radiology (Dr. Clyde Stevenson) supervised the taking of roentgenograms and made the initial roentgenographic interpretations in 1943 and 1953. Both sets of films were later evaluated by Dr. Merrill Sosman, chief of the radiology department, Peter Bent Brigham Hospital, Boston, and consultant to the National Institute of Dental Research, and Dr. Theodore Hilbish, chief of the department of diagnostic x-ray in the Clinical Center, National Institutes of Health.

Physical Examination • A complete physical examination was given all subjects in 1943 and in 1953. The laboratory studies included a determination of hemoglobin, red and white blood cell counts, a differential white count, and a serologic test for syphilis. Urine determinations included specific gravity, qualitative albumin and sugar, and microscopic examination.

In 1953, a few additional procedures were included. Rectal and pelvic examinations were made of most of the women, and prostate examinations were routine in men. Hematocrit, sedimentation rate, and blood calcium were determined. When indicated, further studies were made, such as acid and alkaline phosphatase, blood sugar, and special hematology. Consultant service was used when indicated.

The removed subjects were given essentially the same examination by the same Public Health Service physician.

Roentgenographic Examination • The roentgenograms taken at the Scott and White Clinic were made on a 500 ma roentgenographic unit with a rotating anode tube. Emphasis was placed on bone detail. Anteroposterior views of the dorsal spine, the lumbar spine, and the pelvis with the proximal third of the femur were taken for each subject. When a question of unusual findings arose, a roentgenographic bone survey was made that consisted of the following views: lateral skull, cervical spine, left upper arm, forearm and hand, and right femur, lower leg and foot.

Similar roentgenograms were taken at the nearest available facility for the removed subjects.

Oral Examinations • All of the physical examinations included an oral examination by the Public Health Service team. The majority of the participants seen at the Scott and White Clinic in 1953 were also given a complete dental examination by a Public Health Service dentist, and complete dental roentgenograms were taken of practically all of the subjects, including the edentulous. Estimations were made on the degree and

Table 1 • Incidence of abnormal clinical findings, 1943-1953. (Participants residing in study area for the ten-year period)

Characteristic studied	Bartlett			Cameron			Significant difference (P=0.05)
	Number at risk	Number abnormal	Rate (per cent)	Number at risk	Number abnormal	Rate (per cent)	
Arthritic change	80	11	13.8	89	13	14.6	No
Blood pressure							
Sys. 151 mm/Hg & over	58	18	31.0	81	20	24.7	No
Dias. 100 mm/Hg & over	73	11	15.1	83	11	13.3	No
Pulse pressure 75 mm/Hg & over	70	9	12.9	89	16	18.0	No
Bone changes*							
Density†	74	7	9.5	81	2	2.5	No
Coarse trabeculation	74	4	5.4	81	2	2.5	No
Hypertrophic	74	8	10.8	81	6	7.4	No
Spurs	74	1	1.4	81	4	4.9	No
Osteoporosis	74	5	6.8	81	10	12.3	No
Bone, increased density (new cases)	66	1	1.5	79	—	—	—
Cataract and/or lens opacity	79	8	10.1	85	12	14.1	No
Thyroid	74	3	4.1	82	6	7.3	No
Cardiovascular (except uncomplicated hypertension)	80	10	12.5	92	22	23.9	Yes
Hearing (decreased acuity)	72	14	19.4	78	10	12.8	No
Tumor and/or cyst	80	12	15.0	92	10	10.9	No
Fractures	80	12	15.0	92	7	7.6	No
Urinary tract calculi	72	14	19.4	76	12	15.8	No
Gall stones	73	0	0.0	80	1	1.2	No

*Bone changes determined by simultaneous reading of identical views of roentgenograms taken in 1943 and repeated in 1953.

†Bartlett: 4 increased density, 3 decreased density. Cameron: 2 increased density.

prevalence of dental fluorosis, dental caries experience, gingivitis, alveolar bone loss, and other types of oral pathology. The details of the dental findings are reported on page 272 of this issue of THE JOURNAL in an article by Dr. Zimmermann.

It should be noted that this investigation was not initially designed as a dental caries-fluoride study. The oral findings constitute but one phase of a medical-experience study. The age distribution of the participants was predominantly in the older age groups and, therefore, not as suitable as might be desired for some types of dental studies.

OBSERVATIONS

Analysis of the data produced the following conclusions:

1. As was expected, dental fluorosis was significantly greater in Bartlett than in Cameron (all of the participants born and in continuous residence in Bartlett during the tooth formative period exhibited positive evidence of dental fluorosis).

2. The incidence of cardiovascular disease was higher in Cameron, an observation unrelated to fluoride ingestion.

Table 2 • Prevalence of abnormal laboratory findings, 1943 and 1953. (Participants residing in study area for the ten-year period)

Laboratory determination	Year	Bartlett			Cameron			Significant difference (P=0.05)
		Number examined	Number abnormal	Rate (per cent)	Number examined	Number abnormal	Rate (per cent)	
Hemoglobin	1943	116	34	29.3	121	37	30.6	No
	1953	79	20	25.3	83	26	31.3	No
Hematocrit	1943	—	—	—	—	—	—	—
	1953	79	5	6.3	82	7	8.5	No
Red blood count	1943	116	25	21.6	121	24	19.8	No
	1953	80	6	7.5	85	2	2.4	No
White blood count	1943	116	17	14.7	121	5	4.1	Yes
	1953	78	11	14.1	82	7	8.5	No
Differential count								
Neutrophils	1943	71	15	21.1	71	6	8.5	Yes
	1953	78	23	29.5	82	13	15.9	Yes
Lymphocytes	1943	71	2	2.8	71	1	1.4	No
	1953	78	35	44.9	82	36	43.9	No
Eosinophils	1943	71	0	0.0	71	0	0.0	No
	1953	78	6	7.7	82	14	17.1	No
Sedimentation rate	1943	—	—	—	—	—	—	—
	1953	79	31	39.2	83	22	26.5	No
Blood calcium	1943	—	—	—	—	—	—	—
	1953	79	9	11.4	66	7	10.6	No
Serology (S.T.S.)	1943	71	2	2.8	71	3	4.2	No
	1953	84	2	2.4	95	2	2.1	No
Urine albumin	1943	115	3	2.6	121	10	8.3	Yes
	1953	77	5	6.5	85	12	14.1	No
Urine glucose	1943	115	2	1.7	121	4	3.3	No
	1953	77	0	0.0	85	1	1.2	No

3. There were no significant differences between the age-adjusted death rates in the two towns.

4. The two groups showed no significant differences in the ten year period with respect to changes in blood pressure, arthritic conditions, eyes, thyroid disorders, hearing, tumors, cysts, bones and bone fractures, and the urinary system (Table 1).

5. The only difference in laboratory findings was in the white blood cell count, which tended to be higher in Bartlett in 1953. White blood cell counts are normally subject to considerable variation and, when viewed in the light of clinical experience, this finding does not suggest an association with fluoride intake (Table 2).

When the data are reviewed critically, it is clear that the medical characteristics of the two groups, with the exception of dental fluorosis, do not differ more than would be expected of two comparable towns with or without an excess of fluoride in the water supply.

Minor tooth movement by means of rubber-dam elastics

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The problem of tooth position arises in many phases of applied clinical dentistry. In restorative dentistry, for example, if a tilted tooth can be moved into an upright position or if a tooth completely labial or lingual to its opponent can be brought into the correct occlusal relationship, restorations involving these teeth are likely to be more effective and permanent. In addition, the preparations can be kept further from the pulp chambers, and in some cases devitalization may thereby be avoided. A typical example of such preventive work is illustrated in Figure 1.

Returning a tooth which has drifted mesially, distally or labially to its correct position may make it possible to construct a better bridge because paralleling problems are reduced and the proper space is created for the pontics. The position of a tooth in relation to its adjacent teeth and its opponents is of extreme importance, since the position of the contact points and marginal ridges and the shape and position of the embrasures can be major local environmental factors in the etiology of periodontal disease and caries.

Malposed teeth can cause premature occlusal contacts which in turn may cause sliding of the mandible both in mastication and in habitual nonfunctional grinding and clenching.

In certain instances of periodontal disease, teeth which have migrated labially will return to their original positions when deep palatal pockets have been treated and occlusal trauma removed. In cases where this return does not occur in a few weeks or where prompt movement is required in accordance with a schedule of restoration, light forces must be applied to the migrated tooth to return it to its correct position. If a tooth which has migrated can be returned to a more vertical position or if an occlusal disharmony can be corrected by moving the traumatized or traumatizing tooth, periodontal treatment can be more effective.

Furthermore, since for psychological reasons the objective of dentistry in general is to achieve the best esthetic results consistent with good function, it is desirable to effect a pleasing and harmonious alignment of the anterior teeth.

In many cases, these changes must be accomplished by complex methods requiring highly specialized training, and in some mouths they cannot be achieved by any means at all. In a great number of cases, however, certain technics can be used by the general practitioner to produce minor movements which accomplish the required purposes. These technics should be considered a part of restorative dentistry, a part of perio-

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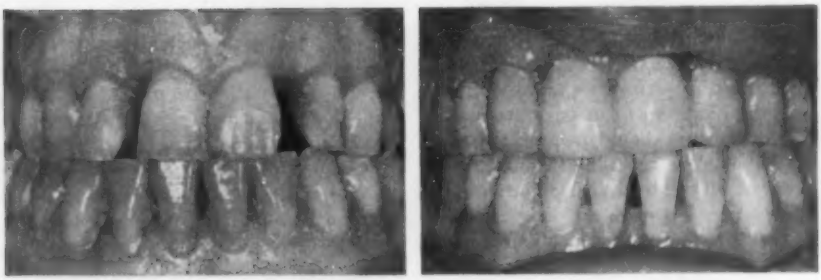

Fig. 1 • Example of results accomplished with rubber-dam elastics. Left: Upper lateral incisors in which periodontal destruction and distal drift had occurred. Right: Appearance after lateral incisors were moved mesially with rubber-dam elastics and the four incisors were splinted together. (Courtesy of C. C. Bastian)

dontics—in short, an important part of dentistry. For this reason, they are being taught to undergraduate and postgraduate students.

These minor movements are usually limited to one or two teeth, although a greater number may be involved. The distance the teeth are moved is generally less than 3 mm. If there is an incorrect spatial relation of the mandible to the maxilla, of the mandibular to the maxillary dentition, or of one or both dentitions to the skull as a whole, the minor movement technics, such as the use of rubber-dam elastics, cannot be expected to correct this relation; major movements by means of more complex orthodontic appliances are necessary. If, however, the incorrect relation is merely between a tooth and its adjacent or opposing teeth, the use of rubber-dam elastics may be considered.

The minor movements are produced by the application of forces derived from the elasticity of metals, elastic acrylic resin or rubber, or from the contraction of silk. The various technics for the use of rubber-dam elastics described in this paper employ the well-known principles of diagnosis, of physiology of the periodontium, and of the application of pressures applicable in all the methods.

DIAGNOSIS AND TREATMENT PLAN

The most essential factor in the successful use of the various technics for minor tooth movement is good diagnosis. As in most dental procedures, these technics can be destructive if they are not carried out circumspectly and are not based on sound principles of treatment. A constant awareness of certain dangers that may be encountered will generally prevent these difficulties from becoming serious.

The steps required in making the diagnosis and in planning the treatment, in the usual order of execution, are as follows:

Obtaining of an Accurate History and a Complete Chart of the Patient's Mouth • The history should include a description of the course and duration of migration if the malposition is an acquired one. The medical, dental and nutritional history should be investigated to ascertain the probable response of the periodontium to the forces which are to be applied to the teeth. A study of the habit patterns, jaw closure patterns and masticatory movements is essential in attempting to discover the etiology of the malposition and to determine the chances for

successful treatment. In other words, one should know why and how the malposition occurred, what are the factors which might make it recur after treatment, and how the recurrence can be prevented.

The charting should include notations of the degrees of mobility and pocket depth of all the teeth, since without this information it would not be possible to detect any possible beneficial or adverse effects of the procedure on the tooth being moved or on the anchor teeth.

Preparation of Good Study Models and of Roentgenograms and Photographs Taken From Several Angles in Order to Demonstrate Progress Accurately • The second step, accurate recording, is essential in the management of a case, since the amount and rate of progress cannot be accurately observed without it. Follow-up records should be made after the movement has been completed so that any regression may be detected. If there is a diastema, photographs and roentgrams should be aimed directly at it, to demonstrate it accurately. These photographs and roentgenograms are made in addition to those taken at the usual angles, since overlapping can destroy the value of the records for the purpose of later comparison.

Determination of Purpose of Movement and Final Positions Desired • It is important to establish in the mind of the patient the reasons for the contemplated procedures, but first these reasons must be clear to the dentist. This clarification will make possible an objective judgment on the dentist's part as to the feasibility of proceeding. It will gain also the active cooperation and understanding of the patient, which are necessary, since most of the procedures involved will be partially controlled by the patient.

If the prognosis of the procedure is relatively poor and extensive retention will be required, the objectives must be of great therapeutic value to make the operation worthwhile. The main reason for undertaking movement procedures in such cases is to provide local environmental factors that are more compatible with dental and periodontal health than those existing at the time of examination. Removal or reduction of excessive stresses in mastication and habit patterns, the placement of restorations and splints for support of weakened and overloaded teeth, and correction of food impaction and food retention mechanisms[1] are often essential to the retention of the dentition. Minor movements which can accomplish these objectives are worth attempting even in many cases which are not completely favorable or will require fixed retention.

For patients in public life or for those with certain psychological problems, the esthetic appearance of the anterior teeth may be sufficiently important to warrant a procedure which has only moderate chances of success or which will involve complex retention methods. In most cases, the esthetic factors are not that urgent. If the risks are negligible and the chances of success excellent, however, the movement may be undertaken even if merely for purposes of esthetics.

If it is understood from the beginning that partial correction of the malposition is all that can be expected under the circumstances and that the partial correction can be maintained satisfactorily, it may still be reasonable to proceed, since that amount of correction may be better than none. On the other hand, the patient and the dentist must be aware of the possible steps that may be necessary for retention—in some cases, fixed splinting—and the prospective benefits from the procedure must be weighed against such contingencies. In many cases this evaluation may well cause a dentist to refrain from performing the procedure.

1. Hirschfeld, Isador. Food impaction. J.A.D.A. 17: 1504 Aug. 1930.

Decision as to Possibility of Producing Desired Movement • The following prerequisites must be met, or the procedure is likely to fail:

1. There must be sufficient room between the teeth adjacent to the tooth being moved to permit its entry into the space, or else it must be possible to gain such room by reshaping or moving the adjacent teeth. The reshaping may be done by judicious stripping of the proximal surfaces or of proximal restorations or by making new restorations. The final contact points should be tangential rather than flat to prevent caries, and therefore the stripped surfaces should be carefully rounded and polished. Extremely crowded teeth or teeth with thick necks are less favorable for reshaping than bell-shaped teeth with abundant mesial and distal enamel. If there is a space near the tooth adjacent to that being moved, the adjacent tooth itself may be moved mesially or distally to increase the room (Fig. 2).

2. The tooth to be moved must be clear of occlusal interference in all excursions of the mandible at all stages of the tooth's movement into the desired position. If this is not the case, it must at least be possible to grind or depress it or its opponents sufficiently to fulfill this prerequisite. The amount of recession of the pulp chamber and the amount of attrition present may be factors in deciding how much grinding can be done. If the vertical dimension can be increased safely in cases where posterior teeth are missing or excessively tilted or where there is a large freeway space, the increase may permit movement in a lingual or palatal direction of teeth which have migrated labially as a result of occlusal forces.

The only cases in which the prerequisite of occlusal noninterference need not be fully met are those where considerable fixed splinting is to be used for retention and support. Inability to satisfy this prerequisite rules out a great number of cases, especially those with extreme overbites, for if the occlusal interferences cannot be corrected, there will be pain and excessive mobility during the course of the movement; and the tooth will not remain in place more than a short time after the retaining appliance has been removed.

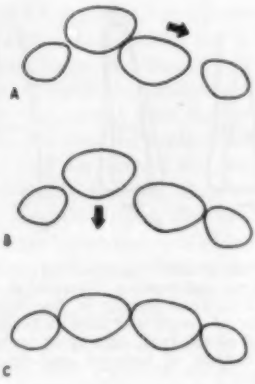

Fig. 2 • Mesial or distal movement to provide room for tooth being brought in from labial side when there is a diastema elsewhere in anterior part of arch

3. The tooth to be moved must be in such a relation to its supporting bone that moving it in the desired direction will not move it off the ridge, as that movement might lead to resorption of the labial or lingual alveolar walls and to possible eventual loss of the tooth. This is especially true of anterior teeth.

4. The tooth to be moved must have its long axis in such a direction that the tipping force employed in these technics will not move the tooth into a more unfavorable relation to the ridge and to the lines of occlusal force. There are two ways in which a tooth can be moved—bodily and by tipping (Fig. 3). With complex fixed orthodontic appliances it is possible to cause bodily movement, with the root apex moving in the same direction as the crown. With the rubber-dam elastics and most other methods, the tooth is tipped by application of a simple

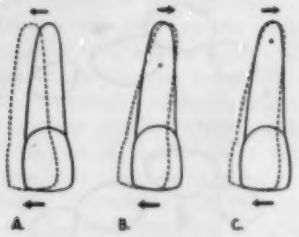

Fig. 3 • A, bodily movement of tooth with root apex moving in same direction; B, tipping of tooth with apex moving in direction opposite to that of crown and with fulcrum apical to crest of alveolus; C, tipping of tooth when alveolar support is reduced and fulcrum is nearer apex

force to the crown.[2-4] The apex moves in a direction opposite to that of the crown; and there is a fulcrum present, its location depending on the height of the alveolar bone on the side towards which the crown is moving.

The tipping action which these methods cause is not necessarily disadvantageous. Most teeth which have moved into incorrect positions, in the cases suitable for treatment with the minor movement methods, have moved originally with a tipping action as a result of forces being applied to their crowns. The tipping action in repositioning them merely returns their long axes to a more correct relation to the supporting bone.

Another factor minimizing the effect of the tipping is that these minor movements are usually rather limited, and the tooth is not tipped too severely when the crown moves over small distances. When anterior teeth are tipped, a certain amount of reshaping by grinding may be necessary to obtain the proper incisal contours.

Since the occlusal portions of the crowns of the mandibular posterior teeth are generally lingual to those of the maxillary teeth, the mandibular teeth usually are inclined in a lingual direction and the maxillary teeth more labially. Their long axes may be visualized as in Figure 4. If a tooth is malposed in position AB or AC, it can be moved beneficially to position AA′; but if it is malposed in position AA′, it is generally disadvantageous to move it to AB or AC, since it would then receive strong lateral forces which its supporting structures could not withstand as well as the axial forces received in position AA′.

5. Forces which have caused the tooth in question to move into its malposition must be corrected, unless fixed permanent retention is contemplated to distribute the abnormal pressures over several teeth. Tongue habits, the various biting habits, bruxism and granulation tissue in deep periodontal pockets must be eliminated if the tooth is to remain in its corrected position. Some of these habits are extremely difficult to correct, and if continued they will prevent any permanent benefit from the methods described in this article.

6. Any necessary periodontal treatment should be completed before the

2. Case, C. S. A practical treatise on the technics and principles of dental orthopedia and prosthetic correction of cleft palate. Chicago, C. S. Case Co., 1921, p. 101.

3. Oppenheim, Albin. Biologic orthodontic therapy and reality. Angle Orthodont. 6:69 April 1936.

4. Stuteville, O. H. Orthodontia studies. Northwestern Univ. Den. Res. & Grad. Quart. Bul. May 6, 1935, p. 6.

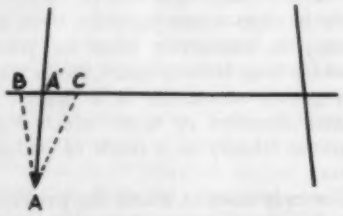

Fig. 4 • Correction of position of long axes of posterior teeth. Tooth malposed as in position AB or AC can be moved beneficially to position AA′; but the reverse is usually not true, since tooth would then receive heavy lateral stresses

movement is attempted, as it is important that inflammation be minimal and tissue resistance maximal in order to have the complicated balance of breakdown and repair, which results in the movement of a tooth, proceed as well as possible. A tooth may be moved successfully even though it has less alveolar support than normal. In fact, the crown of such a tooth will be moved a specific distance faster and with less tipping action than a tooth with normal support because of the lower fulcrum. When the clinical inflammation has been relieved, a tooth which has periodontal involvement but a favorable periodontal prognosis can generally be moved successfully if the other prerequisites have been fulfilled.

Decision as to Method • When it has been judged that a tooth or teeth can be moved safely by one of the minor movement technics, consideration is given to problems of anchorage, the amount of movement necessary, the distribution of teeth, occlusal factors, the patient's hygiene habits and manual dexterity, as well as to the esthetic and psychological problems involved.

For mesiodistal movement, when there is no anchorage problem resulting from mobility or poor distribution of the anchor teeth, the rubber-dam elastics or contracting silk ligatures are indicated. The elastics generally are preferred because they exert a lighter force, which has been demonstrated to be more effective and less damaging to the periodontium.[5, 6] They are also more compatible with oral hygiene, as they are removed by the patient during meals, whereas silk ligatures remain in place.

Elastics sliced from rubber tubing have been used for at least one hundred years to perform many of the movements to be described in the latter half of this paper.[7, 8] The rubber-dam elastics used today, however, exert much lighter forces; furthermore, there are now better technics for anchorage and control of movement. In 1944, Oppenheim,[5] in advocating the use of rubber-dam elastics for traction in extraoral force appliances, tested the amounts of force exerted by various types of elastics stretched over similar lengths. He observed that the rubber-dam elastics exerted half the force of the next lightest type of elastic and less than a third of that of the other types. The elastics used in his experiment and available commercially today are small circles punched out of a rubber dam or cut from a long tube of rubber-dam material.

When there are anchorage problems and steel wire ligatures cannot be used for supporting anchor teeth for one reason or another, the use of the acrylic-and-wire appliance, similar in some respects to the Hawley retaining appliance,[9] is the method of choice, as it obtains its anchorage over a wide area and many teeth. The acrylic-and-wire appliance consists of an acrylic palate or horseshoe, an anterior labial arch wire, clasps and springs. The use of this appliance is the preferred technic in many cases where rotation of anterior teeth is desired or when several simultaneous types of movement are planned in different sections of the arch. It is especially valuable when the teeth to be moved are in the posterior regions. The presence of a partial denture may make its use impractical in certain cases, but the necessary springs and arch wires often can be soldered to the partial denture itself.

A variation of the acrylic-and-wire appliance, used in conjunction with rubber-dam elastics, is often excellent for labio-

5. Oppenheim, Albin. Possibility for physiologic orthodontic movement. Am. J. Orthodont. & Oral Surg. 30:345 July 1944.

6. Nelson, Beulah G. Value of light intermittent force in the treatment of malocclusions. Angle Orthodont. 20:39 Jan. 1950.

7. Weinberger, Bernard W. Orthodontics: an historical review of its origin and evolution. St. Louis, C. V. Mosby Co., 1926, p. 346.

8. Proceedings of Dental Societies. Pennsylvania Association of Dental Surgeons. D. Cosmos 1:179 Nov. 1859.

9. Hawley, C. A. A removable retainer. Internat. J. Orthodont. 5:291 June 1919.

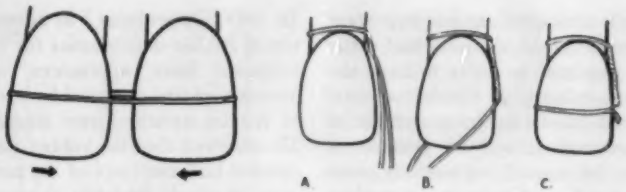

Fig. 5 • Left: Position of elastic about teeth. In moving two teeth toward each other, elastic encircles teeth in about middle third of crowns, incisal to cingula and gingival to contact points. Right: Application of accessory wire. A—Loop of wire is tightened apical to cervix so that it cannot be pulled incisally. B—Enough twists are made to enable strands to encircle crown incisal to cingulum. C—Second loop is made and cut off in such a way that final twisted section acts as spur in interproximal space to retain elastic in correct position.

lingual movement and for some forms of rotation, with a lighter pressure exerted than is possible with springs. In other instances, the light recurved springs of an acrylic-and-wire appliance are more practical, and the latter appliance might well be a part of every dentist's armamentarium, since it can be used for many types of movement.

For very minor rotations of anterior teeth, rubber or elastic acrylic positioners[10] are usually preferable. For "jumping" posterior teeth, orthodontic bands with cross-elastics[11] and several other methods are practical.

There are certainly exceptions and additions that can be made in this general classification of methods; nevertheless, it does provide a starting point for the selection of methods.

TECHNICS FOR MESIODISTAL MOVEMENT

There are two major types of mesiodistal movement which may be performed with the rubber-dam elastics. In the first category, two teeth are moved toward each other. In the second, one tooth is moved toward a second, which remains in place.

In either case, the force that causes the movement of one tooth is equalled by a reciprocal force applied to the other tooth which the elastic encircles, but the effect of the reciprocal force may vary in different circumstances. For instance, if the elastic is placed around two teeth and one has considerably more alveolar support than the other, the tooth with less bone will move toward the one with more, in response to the force exerted by the stretched elastic in its contraction to its original shape. If the alveolar support of the two teeth is equal, they will move toward each other.

If it is desired to move only one of the teeth, the force reciprocal to the force causing the movement must be distributed over several teeth in order to have considerably less stress on each one of the anchor teeth than on the tooth being moved. There are a number of ways of accomplishing this purpose.

The simplest type of mesiodistal movement to perform is the movement of two teeth toward each other, since the reciprocal forces are both working in desired directions. To move two central incisors together, for instance, the elastic is stretched between the fingers and looped about both teeth, a force being applied

10. Kesling, H. D. Co-ordinating the predetermined pattern and tooth positioner with conventional treatment. Am. J. Orthodont. & Oral Surg. 32:285 May 1946.

11. Strang, R. H. Textbook of orthodontia, ed. 2. Philadelphia, Lea & Febiger, 1943, p 521.

to the distal surface of each tooth (Fig. 5, left). It is important to be certain that the elastic is incisal to the cingula in order to prevent it from sliding cervically.

In certain instances, it is apparent that the elastic will slide cervically or will slide off the teeth as a result of excessive divergence or convergence of their long axes or of their distal surfaces. In these cases, a simple application of a steel wire accessory ligature will almost always retain the elastics.

A four-inch length of no. .008 inch wire is looped about the neck of the tooth and twisted with a hemostat or pliers until it is tight and the loop cannot be pulled incisally over the cementoenamel junction (Fig. 5, right, A). The wire is twisted enough times to permit its ends to be looped about the crown of the tooth incisal to the cingulum (Fig, 5, right, B).

The second loop is tightened in such a way that, when the twisted section is cut short, a spur remains in the interproximal space away from the diastema being corrected (Fig. 5, right, C). The first loop prevents the wire from slipping off the tooth, and the second loop prevents it from being displaced gingivally.

If it is feared that the elastic will slide cervically, the spur is turned incisalward (Fig. 5, right, C), and the elastic is placed incisal to it. If it is desired that the elastic be prevented from slipping off, the spur is turned gingivally, and the elastic is placed gingival to it. This accessory wire takes only a moment to apply; and as the period of movement is relatively short, patients generally do not object to its presence.

The use of no. .008 inch wire rather than heavier wire is desirable in order to cause minimal interference with the approximation of the teeth in the final stages of the movement. Waxed nylon thread or dental floss can be substituted for the accessory wires in those cases where esthetic factors are particularly important.

The floss is looped below the cervix and tied tightly. Enough knots are made to bring the two strands incisal to the cingulum, and a second loop is then made. The knot of the loop acts in the same way as the spur of the wire and is generally effective for at least a week. The floss can be applied in less than a minute and can therefore be replaced periodically without much loss of chair-time.

If two teeth are to be moved toward two other teeth, two elastics are used. If they are applied as in Figure 6, left, the elastic around the lateral incisors is stretched much farther than the one around the central incisors and may stand away from the palatal surfaces of the teeth. If they are applied as in Figure 6, right, the same forces are applied; but the elastics are stretched equally and

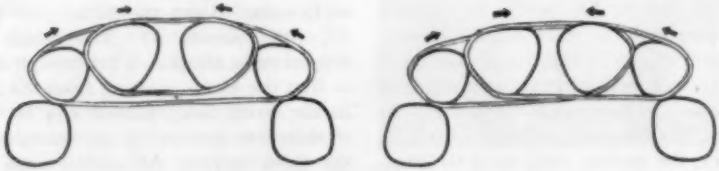

Fig. 6 • Incorrect and correct methods of moving two teeth toward two other teeth. Left: Elastic around two lateral incisors stretched much more than elastic around central incisors and it also stands away from lingual surfaces of teeth. Right: Defects on left corrected by better arrangement of elastics

Fig. 7 • Diastema (left) between upper central incisors corrected (right) by movement of four incisors mesially by means of elastics arranged as shown in Figure 6, right

remain close to the teeth. In the case illustrated in Figure 7, the elastics were applied as in Figure 6, right.

If the purpose of the procedure is to move one tooth toward another, the latter must be anchored to adjacent teeth in one of four ways:

1. If the anchor group is in a fairly straight line with the tooth to be moved and the anchor teeth are in proximal contact, the elastic should encircle the whole anchor group and the tooth to be moved, as illustrated in Figure 8. Part of the reciprocal force applied to the distal surface of the anchor tooth farthest from the tooth being moved is transmitted through the contact point to the other anchor tooth. The force on each is about half that applied to the tooth being moved, and therefore the anchor teeth are not likely to move significantly. Figure 9 shows a case in which this type of arangement was used.

2. If the anchor teeth are slightly separated and therefore cannot provide proximal support (Fig. 10, above) or if they are not in a fairly straight line and the elastic consequently will not lie against the lingual surfaces (Fig. 10, center), the anchor teeth must be firmly ligated together with stainless steel wire, and the elastic is then placed about the tooth to be moved and the nearest of the anchor teeth (Fig. 10, below). A method for ligating the anchor teeth has been described recently.[12] For making a two-tooth anchor, a figure-8 ligature also may be used.

3. When the anchor teeth are in contact but are not in a straight line with the tooth being moved, they can be made into a unit by encircling them with a separate elastic. This method is quicker and easier than the wire ligation, but the anchorage it provides is not quite as effective.

4. When accessory anchorage is necessary for mesiodistal movement of a tooth and wire ligatures cannot be used for esthetic reasons, a modification of the acrylic-and-wire appliance can be used for anchorage (Fig. 11, left). It can have a .030 inch chrome alloy wire—with one end embedded in the acrylic resin—extending up the lingual side of the interproximal space, one space away from the diastema being closed, over the incisal surface and down the labial side (Fig. 11, right above, A). The labial and lingual arms are placed far enough apart so that the elastic running from the arms to the tooth being moved can be in a straight line, preventing any contact with the tooth between the anchor arms and the tooth being moved, since that contact

12. Hirschfeld, L. The use of wire and silk ligatures. J.A.D.A. 41:647 Dec. 1950.

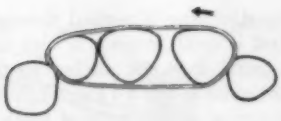

Fig. 8 • Adjacent teeth used as anchor group; in contact with each other and in fairly straight line with tooth being moved

would apply to it undesired pressure in a labial or lingual direction. The elastic in position has the rough outline of a long triangle with a rounded apex (Fig. 11, right below). No labial arch is needed for this appliance.

If two or more teeth are to be moved in one direction, separate elastics generally are required for each tooth.

Unlike the acrylic-and-wire appliance, which moves a tooth a certain distance and then stops its action when the spring or arch wire becomes passive—the distance can be determined by the amount of bending of the spring or the removal of a certain amount of acrylic resin on the side of pressure—the rubber-dam elastic does not have such a stopping point. It will continue to exert pressure until it returns to its original shape, which has a circumference about the size of one tooth.

There are times when it is desirable to move a tooth only part of the distance to its adjacent tooth and a barrier must be provided to prevent excessive movement. Sometimes the final point is a millimeter or so away from the adjacent tooth in order to have the long axes parallel for splinting; and at other times it is desirable to cause a slow, stage-by-stage movement of a tooth over a fairly long distance.

This movement can be achieved sometimes by having the patient return daily and by ceasing the movement at the proper time, but the use of an acrylic interproximal stop permits better control. When an acrylic-and-wire appliance is used in conjunction with the elastics, a finger of acrylic can be extended into the diastema between the teeth and then cut away by stages to permit the tooth to be moved a definite distance—equivalent to the amount of acrylic resin cut away.

In the frequent cases where no acrylic-and-wire appliance is being used, a small acrylic stopblock may be made easily in the following manner. A small piece of baseplate wax is warmed and adapted with the finger to the lingual and incisal surfaces of the teeth on either side of the diastema. This procedure may be performed in the mouth or on a cast with a suitable separating medium, such as tin foil. A 2 inch piece of .010 inch

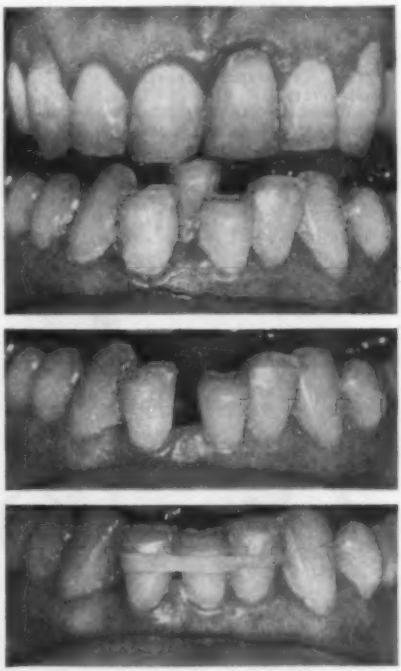

Fig. 9 • Above: Lingually malposed lower right central incisor. Center: Space immediately after extraction. Below: Movement effected with elastics anchored on left central and lateral incisors

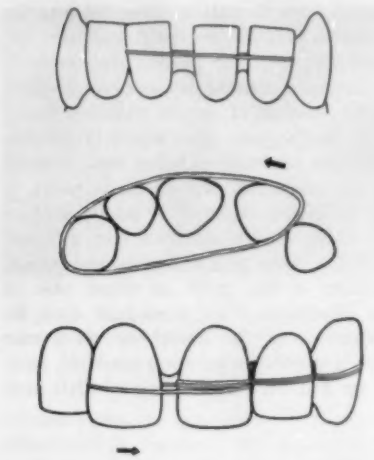

Fig. 10 • Above: Separated teeth incapable of providing proximal support. Center: Teeth unsatisfactory for anchorage because they are not in straight line with tooth to be moved. Below: Practical method in these cases. Anchor teeth are wired together and elastic is placed about tooth being moved and nearest anchor tooth

stainless steel wire is pushed through the wax and is held in such a way that it curves parallel to the anchor tooth but does not quite touch it (Fig. 12, left).

Fast-setting acrylic resin of tooth color is placed in the resulting concavity, which has for its walls the wax, the two teeth and the gingival papilla; and the resin is allowed to set. Then the wire is pulled out; in the small hole which remains, the slightly smaller .008 inch wire can be inserted to wire the stopblock to the anchor tooth.

This wiring is done easily (Fig. 12, right) by making a cervical loop and twisting it enough times to reach past the cingulum, just as was done in Figure 5, right, A. One strand is then passed to the lingual side, across the lingual or palatal surface and through the hole in the stopblock, brought back across the labial surface and then twisted with the other strand until it is tight. The block has previously been trimmed apically and incisally, and a sufficient amount of acrylic resin is removed on the side facing

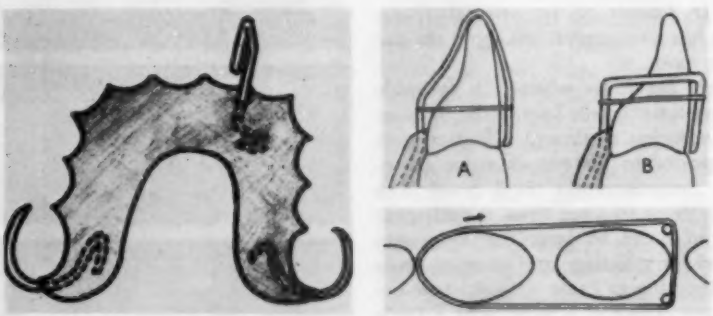

Fig. 11 • Left: Modification of acrylic-and-wire appliance, with arm extending from acrylic resin up lingual surface and down labial surface between two teeth short distance from tooth being moved. Rubber-dam elastic is placed around lingual and labial portions of wire and tooth being moved, right below. Right above, A: Anchor arm embedded in acrylic resin lingual to tooth, extending up lingual surface over incisal edge and down labial surface, ending with slight curve at gingival margin. B: Anchor arm not brought up over incisal surface when there is an open contact. Right below: Labial and lingual parts of anchor arm placed far enough apart so that elastic does not disturb tooth between anchor arm and tooth being moved

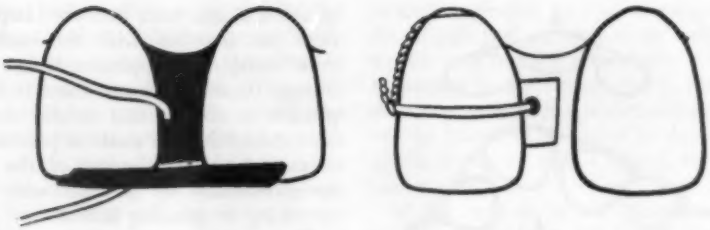

Fig. 12 • Left: Acrylic stopblock, made with warm baseplate wax adapted to lingual surfaces of teeth on either side of diastema. Wire is pushed through wax and held .5 mm. from tooth, following its contour. Fast-setting acrylic resin is placed in diastema, embedding the wire, which is withdrawn after acrylic resin sets. Right: Block trimmed, with enough acrylic resin cut away where it faces tooth being moved that movement desired is permitted. Block is then wired to anchor tooth

the tooth being moved to permit the desired movement. It is not essential to polish the block to any great extent, as it is used only temporarily. At the next stage of the movement, the wiring is repeated after the removal of an additional amount of acrylic resin. The wiring should take less than a minute.

TECHNICS FOR LABIOLINGUAL MOVEMENT

In many cases it is advantageous to cause the movement of one tooth or a group of teeth in a labial or lingual direction. This movement may be accomplished effectively with acrylic-and-wire appliances by the use of labial arch wires and springs of various types embedded in the acrylic resin or soldered to the arch wires. The lighter force applied to the tooth by the rubber-dam elastics, however, is an advantage which may lead to consideration of their use for this purpose. The problem of anchorage is much more difficult than in mesiodistal movement, but usually it can be solved.

If it is desired to move a tooth palatally into a space which is large enough to accommodate it, a simple application of the elastic as in Figure 13, above, would seem to be indicated. The forces reciprocal to those moving the tooth palatally, however, tend to cause the adjacent teeth to move together, closing the space to some extent. If that is desirable—in certain instances, the space is larger than the tooth—this arrangement of the elastic is adequate. Since in most cases the tooth will barely fit into the space it is to occupy—and the space may even have had to be enlarged by the methods illustrated in Figure 2—a better form of anchorage usually must be found.

One way of providing anchorage is to ligate groups of teeth on each side of the space to reduce the mesiodistal pull on the teeth adjacent to the space (Fig. 13, below). This method is only partially effective, especially in a sharply curved arch; and a third form of anchorage for the elastics is then required. This consists of an acrylic-and-wire appliance similar in some respects to that described earlier in the paper.

The appliance consists of an acrylic palate or horseshoe and two to four clasps to provide maximum stability. When a tooth is being moved in a lingual or palatal direction, no anterior labial arch wire is necessary; a small cleat is embedded in the acrylic resin in such a way that when an elastic is placed around the tooth and the cleat, the force will be applied in the proper direc-

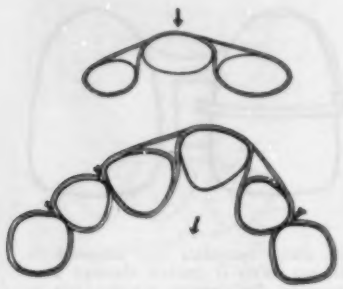

Fig. 13 • Above: Simple application of elastic to move tooth palatally if space is somewhat wider than tooth. Below: Mesiodistal pull on adjacent teeth reduced by ligating anchor groups on each side

tion. If the tooth is to be moved lingually, the cleat is embedded directly lingual to the tooth as in Figure 14, above. If the tooth is to be moved mesiolingually or distolingually, the cleat is arranged so that the elastic pulls in the proper direction. Cleats may be moved at different stages by cutting them out of the acrylic resin with a fissure bur and resetting them with self-curing resin on a tin-foiled model.

The cleats are made by bending .025 inch chrome alloy wire in a hairpin curve and making another bend in the two arms of the hairpin about ⅛ inch from the first bend. The arms are curved outward slightly for better retention in the acrylic resin and cut off ¼ inch from the second bend (Fig. 14, below left). This shape permits the cleat to be embedded near the gingival edge of the acrylic resin and to retain the elastic without irritation to the tongue, because it is not sharp and the exposed part lies close to the acrylic resin.

The appliance is placed in the patient's mouth, with care being taken to assure complete seating. The clasps must be effective for retention but should not exert pressure on the clasped teeth when the appliance is in place. When the clasps are of the crib type, it is desirable to use a design such that the clasp wire does not interfere with the occlusion, even though the appliance is not worn during meals. In many cases it is not possible to do this, and careful observation should then be made to prevent any damage from the forcing of the clasp interproximally by patients who have clenching or grinding habits.

The acrylic resin should fit against the lingual or palatal surfaces of all the teeth, including the tooth being moved. It should be trimmed with a stone so that there is a mere knife-edge in contact with the cervical parts of the crowns of the tooth to be moved and its adjacent teeth (Fig. 14, below right, A). This procedure makes adjustments of the acrylic border more accurate.

The amount that the tooth will move lingually in any given stage is determined by the amount of acryic resin cut away lingual to that tooth, and this cutting of the acrylic resin must be done carefully. A good way to control it is to outline the desired line in pencil and make several cuts down to that line with a fissure bur (Fig. 14, below right, B). When these cuts have been joined with the bur or a barrel stone, the correct amount of acrylic resin has been removed. When the next adjustment is being made, additional acrylic resin is removed in the same manner. The tooth will be moved in by the elastic until it is in contact with the new arc of the acrylic resin.

When teeth are moved lingually, the acrylic resin should be cut away for 8 or 10 mm. apical to the cervical line and not just at the cervical line. Otherwise, as the tooth tilts lingually, the gingiva is compressed between the root and the acrylic resin and may recede rapidly. The gingival contour should be checked with the original casts at intervals.

The labial arch wire is not necessary for the movement, but it is convenient to have when the appliance is used later for retention. During the movement, while the appliance is worn during the

day, the labial arch may be omitted for patients to whom esthetics are essential. Although the clasps may be apparent in the bicuspid areas, the esthetic appearance will be satisfactory, since the stretched elastics are almost the same color as the teeth. When the movement has been completed, the labial arch may then be set into the acrylic resin, or another appliance may be made as a retainer, to be worn only at night.

A certain amount of rotation of anterior teeth can be accomplished, in a procedure similar to that employed for the labiolingual movement, by removing acrylic resin in such a way as to provide a fulcrum in the correct place. The desired axis of rotation is determined and will be found to be either in the center of the tooth or at the mesial or distal corner (Fig. 15).

If the axis is at the center of the tooth, a force from the labial direction must be applied to one corner of the tooth and one from the lingual side to the opposite corner. This exertion of

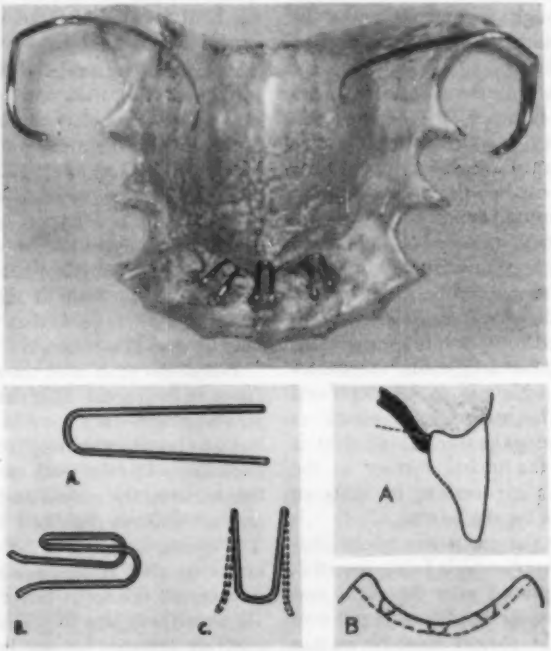

Fig. 14 • Above: Acrylic-and-wire appliance, with two clasps and three cleats for anchoring of elastics which are to move upper incisors palatally. Below left: Cleats made by making hairpin bend in .025 inch chrome alloy wire, A, and bending both arms ⅛ inch from first bend. Arms are curved outward and cut off about ¼ inch from second bends, B; and cleat is embedded in acrylic resin, C. Below right, A: Acrylic resin lying against tooth to be moved trimmed to knife-edge. B: Guide for cutting resin. Desired amount of acrylic resin is outlined in pencil, and several cuts are made with fissure bur down to pencil line. Then cuts are joined

Fig. 15 • Determination of axis of rotation. A: If axis is to be at one corner of tooth, acrylic resin may be used as fulcrum, and elastic will exert pressure in other corner. B: If axis is to be in center of tooth, force from palatal side is required, and this method is not applicable

force is not possible with the rubber-dam elastics, although it can generally be acomplished with springs of an acrylic-and-wire appliance.

If the axis of rotation is at one corner of the tooth, however, the acrylic resin there can act as a fulcrum, and the elastic can then move the tooth into the desired position when the proper amount of acrylic resin has been cut away.

When a small amount of depression of the teeth being moved palatally is desired in order to avoid excessive grinding, the labial arch wire may be used, with a hook soldered to it, pointing gingivally. The hook is placed opposite the center of the tooth which is to be depressed (Fig. 16). The rubber-dam elastic is hooked on the palatal cleat so that it extends over the incisal surface to the labial hook. As it contracts, it exerts an intruding force on the tooth.

To facilitate the placement of the elastic when the appliance is being inserted, the elastic is placed over the cleat and the hook before the appliance is put into the mouth. The patient must be certain that the elastic lies in the correct place. He can adjust it easily with a toothpick or a paper clip if it slides between the teeth instead of over the incisal edge when the appliance has been inserted.

If four incisors are to be depressed slightly while they are moved palatally, four hooks are used, one opposite each tooth. The four cleats can be made by bending an .025 inch wire and embedding half of the resulting serpentine wire in the acrylic resin. It is essential that the appliance be firmly retained by the four clasps and the acrylic projections, if the force reciprocal to that depressing the teeth is not to dislodge it.

If a tooth is to be moved in a labial direction, a labial arch wire is necessary for anchorage. Two small diverging spurs are soldered to the arch wire as in Figure 17, above. The elastic hugs the lingual or palatal surface of the tooth being moved and passes through the interproximal spaces labially toward the arch wire, being held in place by the spurs soldered to the arch wire.

A third spur, soldered to the lingual surface of the arch wire, can act as a stop if the original distance between the arch wire and the tooth is more than 1 or 2 mm. (Fig. 17, below). It can be ground off with a stone or disk to the extent desired at each stage of the movement. After the movement has been completed, the newly-formed space betwen the tooth and the acrylic resin is filled with fast-setting acrylic resin so that the appliance may be used as a retainer.

When the plan is to move all four incisors in a lingual direction, an acrylic-and-wire appliance may be made which has two hooks extending from the acrylic resin lingual to the teeth out to the labial side between the cuspid and first bicuspid on each side, as described by Atkinson.[13] The elastic is stretched between the two hooks so that it lies against the labial surfaces of the teeth being moved (Fig. 18, above). It acts as a labial arch wire, exerting pressure on the labial surfaces, but with a lighter force. Two or three elastics may be knotted together to form a longer elastic if it is felt that one elastic would be stretched too far in reaching from one hook to the other.

13. Webster, R. L. Retention. Am. J. Orthodont. 34: 897 Nov. 1948.

Fig. 16 • Left: Upper right central incisor, which extruded while being moved palatally. A hook is soldered to labial arch wire, and elastic extends from hook over incisal surface to palatal cleat. Right: Result after two weeks

When it is desirable to move one tooth labially and the adjacent tooth lingually, the reciprocal forces can both be put to work, as in Figure 18, below. Anchorage must be obtained on both sides, however, with the anchor groups being ligated with wire or encircled by the elastic.

The use of the rubber-dam elastic is most common in the anterior regions, where the teeth have single roots and their anatomy is most favorable for retention of the elastics. They may often be used in posterior regions also if proper precautions are taken to prevent them from sliding cervically on bell-shaped crowns. The knots of wire loops around the cervices can retain the elastics in the correct position. The wire loops themselves may have to be prevented from sliding further cervically by additional wires running over the occlusal surfaces. These wire loops are generally necessary even when a bicuspid is being used as an anchor tooth for the movement of a cuspid or a lateral incisor and are certainly required when the bicuspid itself is being moved (Fig. 19).

PRECAUTIONARY MEASURES

Instructions to the Patient • After the original insertion of the elastics or the appliance, the procedure must be managed carefully if periodontal or pulpal damage is to be avoided. The following precautions are advisable:

1. The patient is instructed in the use of the elastics. He should insert and remove them several times so that the dentist may be certain that he knows how to use them.

2. The patient is given a supply of elastics and told to wear them most of the day and all night. It is suggested that he remove them during meals and tooth brushing to prevent their dislodgment. He is instructed to apply new elastics after each meal. The work of Oppenheim[5] and Bell[14] demonstrated that the elastics exert less force after being in the mouth fluids for many hours.

Frequent Inspection • Two or three days after the insertion of the elastics or the appliance, the dentist should examine the teeth to make certain that movement is beginning and that further grinding is not necessary, since the requirements must be fulfilled at all stages of the movement.

If the patient has pain or notices any loosening of the tooth or teeth being moved, he should return for additional inspection. A slight increase in mobility

14. Bell, W. R. Study of applied forces as related to the use of elastics and coil springs. Angle Orthodont. 21:151 July 1951.

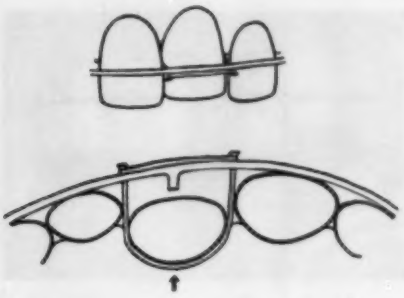

Fig. 17 • Above: Two small diverging spurs soldered to labial arch wire, pointing incisally, at points opposite mesial and distal surfaces of tooth being moved in labial direction. Elastic is looped around spurs and teeth. Below: Third spur soldered to lingual surface of arch wire to act as control; enough ground off to permit desired amount of movement

may be expected, but a greater increase usually indicates occlusal interference. The presence of pain may be due also to occlusal trauma, which must be corrected; but it may be due to slightly excessive force being applied. This force can be reduced by using a larger elastic or a shorter span.

Since movement may occur very rapidly, the teeth should be inspected two or three times a week. Most movements will be completed in a period ranging from a week to two months, depending on the amount of alveolar support and the distance the tooth is to be moved.

Roentgenograms should be made at frequent intervals in order to observe any root resorption or bone destruction which might conceivably occur if excessive forces are applied.

Comment • Several references may be found in the literature [15,16] to the intentional extraction of teeth with rubber-dam elastics in cases of hemophilia and to inadvertent exfoliation of teeth when a circle of elastic is torn from a rubber dam which has been applied for operative purposes and has worked its way apically. It is obviously important, therefore, to be sure that a similar accident cannot occur with the elastics used in these technics.

In the cases of exfoliation described in the literature, the rubber-dam rings had diameters of 1 to 2 mm., the average diameter of a rubber-dam punch hole, and had to be stretched considerably to encircle the root. The rubber-dam elastics used by the authors (Unitek's U-251 and U-252) have diameters in their unstretched state of 6.5 and 8.5 mm. and circumferences of 20.4 and 26.7 mm.; respectively.

The danger of exfoliation obviously does not exist when the elastics are stretched about two or more teeth, for in experiments even molar teeth had to be sawed in half and each root encircled separately to obtain exfoliation. In case of single anterior teeth, however, it was necessary to consider the measurements

15. Massler, Maury, and Aguirre, Bertha. Exfoliation of teeth by means of elastic bands. J. Den. Children 19:56 2nd quart. 1952.

16. Branch and Section Reports. Brit. D. J. 44:1135 Oct. 1, 1923.

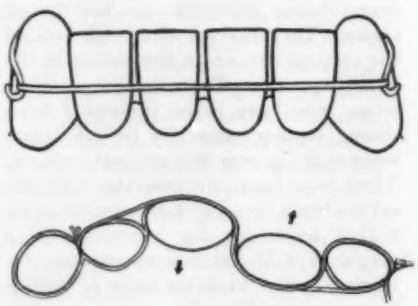

Fig. 18 • Above: Elastic acting as labial arch, employed to move group of incisors lingually, stretched between two hooks embedded in acrylic resin lingual to tooth, extending to labial surface distal to cuspids. Below: Arrangement, taking advantage of reciprocal forces, to move one tooth labially and its neighbor lingually. Anchorage is provided at both ends of elastic

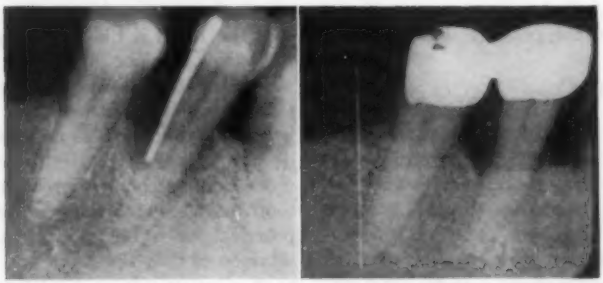

Fig. 19 • First bicuspid, to be used for splinting, moved distally by means of elastics. Wire loops, one on each tooth, prevented elastic from sliding cervically

of the elastics in relation to the size of the roots. According to Diamond's measurements[17] of average tooth size, almost all anterior teeth have a smaller circumference at the root than the smaller elastic. The bicuspids, cuspids and upper central incisors which he described had slightly larger circumferences than the smaller elastic, but the difference was so slight that the minimal stretch which resulted could not cause any damage.

This result was substantiated by clinical tests in which elastics were left on individual cuspids and bicuspids for several days and no apical movement occurred. When the teeth are unusually large, however, it may be safer to avoid using the smaller elastic.

In an evaluation of the feasibility of depressing anterior teeth with rubber-dam elastics, the possibility of strangulation of the pulp should be considered. Butcher and Taylor[18,19] in their experiments with monkey incisors found that an intrusive force of 250 Gm. was necessary to produce ischemia and necrosis of the pulp. They were unable to achieve this pressure with any orthodontic appliances anchored on adjoining teeth. They had to use heavy elastics running through small holes in the incisal portions of the teeth and anchored to wires passed circumferentially about the body of the mandible. They felt that the much lighter forces used in orthodontics would be unlikely to strangulate the pulps of teeth being depressed. Since the rubber-dam elastic would exert a force of about 60 Gm., it may be concluded that depression would be a safe procedure.

Bunch[20] depressed dogs' teeth from 1 to 2 mm. in five weeks with springs. He described the changes in the periodontal membrane and bone but described no pulpal changes. Lefkowitz and Waugh[21] depressed teeth in dogs and found that a continuous mild pressure can intrude teeth in their alveoli in a manner tolerated by the periodontium.

The possibility of pulpal sequelae has not been definitely ruled out, however, and therefore the patient should be instructed to return if any symptoms develop. In Butcher and Taylor's cases, some of the teeth which became ischemic

17. Diamond, Moses. Dental anatomy. New York, Macmillan Co., 1952, p. 143.

18. Butcher, E. O., and Taylor A. C. Effects of denervation and ischemia upon the teeth of the monkey. J. D. Res. 30:265 April 1951.

19. Butcher, E. O., and Taylor, A. C. Vascularity of the incisor pulp of the monkey and its alteration by tooth retraction. J. D. Res. 31:239 April 1952.

20. Bunch, W. B. Tissue changes occurring in dogs incident to depressing movements. Angle Orthodont. 12:177 Oct. 1942.

21. Lefkowitz, William, and Waugh, L. M. Experimental depression of teeth. Am. J. Orthodont. & Oral Surg. 31:21 Jan. 1945.

as a result of the heavy pressure were repaired when the pressure was relieved.

RETENTION

After teeth have been moved, retention is usually necessary.[22] The retention may be for only a few weeks, in cases where all occlusal and muscular displacing forces on a tooth have been corrected; or permanent retention by means of fixed or removable restorations may be necessary. The construction of a partial denture or bridge, in preparation for which the movement may be performed, will usually provide adequate retention. In other cases, permanent fixed splints must be constructed for the double purpose of retention and mutual support of the teeth concerned. At other times, rebuilding and even overextending of proximal fillings or inlays may be performed to prevent mesiodistal regression.

When permanent fixation is not required, a steel wire ligature may be used for 6 to 12 weeks, or an acrylic-and-wire retainer may be employed, which is withdrawn gradually, the time being determined by observation of the tendency to regression. If a removable retainer is used for several months and it is found that the tooth moves out of its correct position when the retainer is withdrawn, either the occlusal factors have not been corrected completely or fixed splinting is necessary. With careful diagnosis and fulfilling of all the prerequisites, the type of retention which will be required can usually be predicted from the outset.

If the tooth is moved into place by a removable retainer during the night and moves outward during the day, an untenable situation exists, since the tooth will remain mobile and may suffer periodontal damage. If it is impossible to remove completely the forces moving the tooth outward and fixed splinting is impractical, it is advisable to adjust the retainer so that the tooth can move out to a position where it can maintain a *status quo*. This position will be somewhere between the original position of the tooth and its corrected position and should represent the best possible compromise. These difficulties are generally encountered mainly in cases of movement in a lingual direction.

SUMMARY

Minor tooth movement can be used to advantage in selected cases. The method to be employed depends on the needs of the particular case. The rubber-dam elastic has been found effective for producing minor movements of one or more teeth. Technics have been developed for producing mesiodistal and labiolingual movements, for effecting certain types of depression and rotation, and for obtaining anchorage for the elastics and controlling their action.

630 West 168th Street

22. Strang, R. H. Textbook of orthodontia, ed. 2. Philadelphia, Lea & Febiger, 1943, p. 598.

Riches • The writings of the wise are the only riches our posterity cannot squander. *Landor.*

Amalgam restorations for Class V cavities

Miles R. Markley, D.D.S., Denver

Class V cavities present special problems for restoration and maintenance. The subsequent health of the gingival tissue and the relative immunity toward recurrent caries depends not only on the excellence of the restoration but also on the patient, because the threat of recurrent caries is greater in the gingival third region than in any other.

Caries in the Class V region occurs and tends to recur in dirty gingival crevices. Round toothpicks provide the surest means for cleansing the crevices in this region. One end of the toothpick is left sharp for cleaning interproximal surfaces. From the other end, 2 mm. of the point is broken off squarely by being bent against the thumb nail or with the incisors. Then 0.5 mm. of the blunt end is reduced to a tiny brush by being bitten with the incisors. The toothpick is kept wet and is rolled slightly between bites so near the end of the pick that the teeth slide off each time. The prepared toothpick is held in the tips of the thumb and forefinger with the brush end firmly against the neck of the tooth and the side of the brush against the marginal tissue. The toothpick is made to ride each free gingival margin back and forth several times. Even the distal surface of the third molars can be scrubbed in this manner with a little effort. The handle end should be elevated for the upper teeth and lowered for the lower teeth. Holding the toothpick with the fingertips close to the working end gives a springy support, making tissue injury almost impossible. The knuckles of the remaining three fingers rest on the chin or face for support.

Once the technic is learned, toothpick cleansing and massage can be done while the patient does something else, such as reading. For several years the author has furnished patients with small wide-mouthed bottles filled with toothpicks to be kept in the glove compartments of their cars. A patient cannot claim that he is too busy to care for his teeth with this simple method available.

Merbromin provides an easy and convincing means of appraising results. After routine cleansing, the patient occasionally paints a 4 per cent solution of merbromin over the teeth with an applicator. Rinsing thoroughly removes the stain from all but the unclean areas, which are startlingly revealed. The patient can perfect methods for cleansing those areas habitually missed. By helping to prevent the recurrence of caries, the patient shares in the responsibility of a successful restoration.

CAVITY PREPARATION AND SHAPE OF RESTORATION

Ferrier's Class V gold foil cavity[1] can be modified to serve admirably for amalgam.

Presented before the Chicago Dental Society midwinter meeting, February 9, 1954.

1. Ferrier, W. I. Clinical observations on areas of erosion and their restoration. J.A.D.A. 20:1150 July 1933.

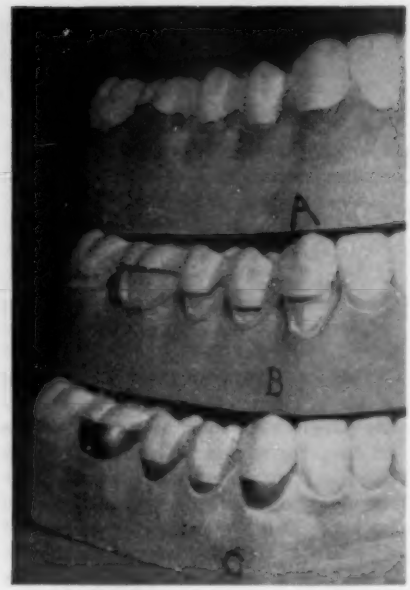

Fig. 1 • Multiple gingival caries without appreciable gingival recession. A: Carious lesions. B: Ferrier type cavity preparations for amalgam restorations, as they would appear if gingival tissue were resected near attachment. C: Finished restorations

Ferrier's Class V cavity outline has two outstanding advantages: it has a better appearance and it lends itself to restoring the best possible contour for the region where there has been gingival recession.

Figure 1, A, shows typical multiple gingival caries. At 1, B, caries has been removed and Ferrier type cavities have been prepared for the amalgam. All occlusal margins are cut parallel to the occlusal plane and to the lip line. The shorter gingival wall is parallel to the occlusal wall and is placed under the free margin of the gum. The mesial and distal walls follow the angles of the tooth, taking advantage of the relative immunity of this region. Caries beyond the angle is restored with an angular extension as shown on the second bicuspid and cuspid. When the gingiva returns to normal, the occlusal margin is the only margin showing (Fig. 1, C). The resulting appearance is a great improvement over the traditional kidney-shaped restoration with odd curves following the vagaries of dental caries. Figure 2 shows conventionally shaped restorations on the upper model and Ferrier type on the lower.

Gingival cavities commonly occur in multiples. It is more efficient to restore multiple cavities by quadrants. Class V cavities can be roughed out quickly under a stream of water before the rubber dam is placed. Occlusal walls are cut parallel to the occlusal plane with a small Jo Dandy disk or diamond wheel. Then the bulk of each region is excavated with small, inverted cone burs. After being roughed out, all but one cavity is filled with temporary stopping. The dam is then placed with the cervical clamp on the tooth having the open cavity, which is perfected and filled first. The temporary stopping in the others prevents leakage of saliva under the dam. After the first filling is condensed and carved, the clamp is moved to the next tooth and is stabilized. The temporary stopping is removed and the cavity perfected; the restoration is placed and carved.

It is fortunate that lingual Class V

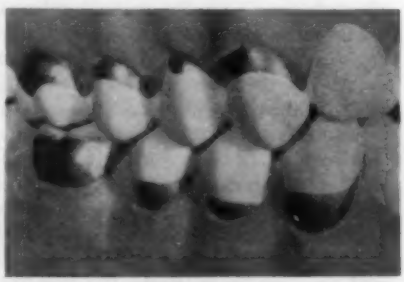

Fig. 2 • Above: Conventional kidney-shaped restorations following outline of dental caries. Below: Ferrier type amalgam restorations

cavities are not common, for they tax the ingenuity of any operator. They must be almost completely prepared before the dam is placed. They are then recut with hand instruments after placement of the dam.

RUBBER DAM

The use of both a cervical clamp and a rubber dam is mandatory for all gingival restorations. The clamp holds the free margin of the gingiva and the dam back to the gingival attachment, so that the cavity and the restoration can be finished well under the free gingival margin, on sound tooth structure and in a perfectly dry field. There is no other way to fulfill these three important requirements. There are few instances where a dam cannot be used by an experienced operator. Medium weight dam of .009 to .010 inch thickness will hug the cervical portion of the tooth. Inverting the dam about each tooth will retract the gingival tissue so that ligatures are seldom necessary. Rubber dam less than .008 inch thick will not retract tissue. The dam is punched with extra space mesial and distal to the tooth or teeth to be restored. The tissue side of the dam about the holes and the teeth to be included are lubricated with soap. Then the dam is slipped over the teeth and through the contacts. A strong thumb nail which is slightly long serves admirably as a separator to introduce each edge of the dam and usually makes the use of Dentotape unnecessary for that purpose. Once the dam is through the contacts, it is clipped in the three-jawed Woodbury dam holder. Then it is stretched back firmly against the investing tissues about the teeth. While being held in this manner, the teeth are washed with hydrogen peroxide applied with cotton and are dried with air. When the dam is released, most of the dam edges will invert themselves about the necks of the dry teeth, blocking seepage effectively. The patient is saved discomfort from ligatures; the operator saves the time of placing them. Those dentists who operate under a spotlight will save eyestrain by using dark colored dam.

Any amalgam restoration for a Class V cavity placed without benefit of a rubber dam and a cervical clamp is a sorry compromise. When a cavity is so deep gingivally that the gum cannot be forced back to support the clamp on sound tooth structure, incisions are made as for a surgical extraction, and a surgical flap is laid back. The dam and clamp are placed, and the cavity is perfected and filled. All debris is then cleared away before the dam is removed. The tissue flap is repositioned and pressed firmly to place. No suture is necessary; the fibrin in the blood holds the flap securely. The incisions heal without complications, faster than bruised and lacerated gingival tissue. This procedure is merely a practical way to restore teeth otherwise condemned to be lost.

In extreme cases, where backward decay has undermined tooth structure under the gingival attachment to, or even beyond, the alveolar crest, it is sometimes necessary to remove a sliver of alveolar bone for full access.

CHOICE OF CLAMPS

Much depends on having the proper rubber dam clamps and knowing how and where to use them. The Ferrier clamp SSW no. 212 excels for all gingival regions on the incisors, cuspids and bicuspids. With the dam in place as previously suggested, stretch the dam back with the thumb and forefinger of the left hand, beyond the buccal (or labial) and lingual tissues about the tooth to be restored. Seat the clamp on cervical tooth structure with the clamp forcep in the right hand. Maneuver the finger or thumb holding the dam on the buccal surface so as to catch that wing of the clamp. Without releasing the dam, slide the wing of the clamp apically,

Fig. 3 • Ferrier type cavity preparation for amalgam. Note direction of enamel rods; occlusal and gingival margins parallel to occlusal plane; mesial and distal margins following angles of tooth; retention grooves in axioocclusal and axiogingival line angles

retracting the tissue past the gingival margin of the cavity. Release the dam so that it is supported by the clamp, now in its proper place, but continue to hold the buccal wing forcefully. Dry the field and apply the heated, low fusing modeling compound to stabilize both bows to the teeth, thus preventing the movement of the clamp from gouging gingival cementum. Do not release the clamp until the compound is cooled and hardened with air. Thin Copalite varnish flowed and dried over the teeth will hold the compound more securely. Invert the margins of the dam about the tooth and the clamp with an instrument. The Ivory no. 6 is useful for the gingival regions on the molars. It and the SSW no. 10, 10A, 11, 11A, and 26 will retract tissue for most normal molar gingival regions. Additional clamps are needed for receded areas. The SSW no. 30 and no. 31 have a buccal point, sometimes used on lower lingual surfaces, that fits bifurcation contours. The points on these clamps must be modified in many instances to follow more closely the buccal contour.

PERFECTING THE CAVITY

After the dam and cervical clamp have been placed, the cavity is perfected with burs and chisels. Class V cavities occur on the convex surfaces of the teeth. Cavity walls should follow the direction of the enamel rods, which, of course, run perpendicularly to the surface of the tooth. Obtuse enamel walls that tend to repel rather than to retain a filling[2] result (Fig. 3).

Thus far, the cavity is prepared as for gold foil. The changes or modifications for amalgam come in the shape of the axial wall and in the type of retention. Also, the amalgam cavity will have no cavosurface bevel.

Amalgam has 2.2 times the coefficient of expansion of tooth structure. It must have a tongue and groove type retention, therefore, to allow for difference in expansion without release of the filling. This is accomplished with grooves cut in the dentin of the axioocclusal and axiogingival line angles. The cavity must be deep enough so that these cuts do not leave unsupported enamel. Sinking the head of a no. 34 inverted cone bur furnishes adequate retention for an occlusogingivally narrow cavity (Fig. 4, above left).

The more convex the tooth surface, and the wider the cavity occlusoapically, the more obtuse will be the enamel walls. An attempt to cut these walls parallel will leave weak undermined enamel rods to fall out and cause failure (Fig. 4, above right).

The inverted cone bur groove may not provide adequate retention for a wide

2. Markley, M. R. Restorations of silver amalgam. J.A.D.A. 43:133 Aug. 1951.

cavity with obtuse walls. A large wheelbur cut across the axioocclusal angle will provide better retention. The axiogingival angle is grooved with a no. 1 round bur (Fig. 4, below left). Both of these cuts are made somewhat at the expense of the axial wall so as not to undermine enamel. It is extremely important that amalgam be condensed into such retention grooves, using condensers with thin blades that will enter the grooves; otherwise retention grooves become traps for mercury.

Another satisfactory method for retaining large Class V amalgam restorations uses threaded stainless steel wire .025 inch in diameter (Fig. 4, below right). Sections of the wire are cut and cemented in holes drilled by large (.026 or .027 inch in diameter) no. ½ round burs in the extreme ends of the axial wall, at safe distances mesially and distally from the pulp. Amalgam is condensed around the threaded pins after the cement is set.

The axial wall of the Class V amalgam cavity is kept as flat as possible mesiodistally to facilitate the condensing of the amalgam. With a flatter axial wall, there is less tendency for the amalgam to skid out distally when it is packed at the mesial side and vice versa. In order for the cavity to have a less convex axial wall, it must be deeper at the height of the buccal convexity than at the mesial and distal ends. It will be from 1.5 to 2 mm. deep in the center and at least 1 mm. deep at either end. Several layers of thin Copalite varnish are flowed over the cut dentin. Then all cavity margins are finished before filling. The varnish provides the only insulation necessary for all except an extremely deep cavity, where a small cement base should be used over a thin capping of calcium hydroxide, zinc oxide and polysterene.[3]

CONDENSING THE FILLING

Small bits of properly proportioned[4] and amalgamated alloy[5] are squeezed and fed into the cavity in turn. The amalgam is condensed forcefully with small instruments into the retention grooves and angles. Then all walls are covered gradually. A 1 mm. diameter condenser gives

3. Zander, H. A.; Glenn, J. F., and Nelson, C. A. Pulp protection in restorative dentistry. J.A.D.A. 41:563 Nov. 1950.

4. Phillips, R. W., and Boyd, D. A. Importance of the mercury-alloy ratio to the amalgam filling. J.A.D.A. 34:451 April 1, 1947.

5. Schoonover, I. C., and Souder, Wilmer. Corrosion of dental alloys. J.A.D.A. 28:1278 Aug. 1941.

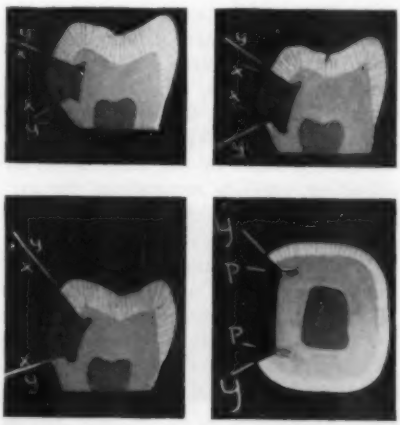

Fig. 4 • Cross sections of gingival amalgam restorations. Above left: Safe restoration where walls of cavity narrow occlusogingivally follow enamel cleavage. Above right: Cavity walls cut parallel at x-x for retention result in failure. Enamel rods run perpendicularly to the surface, as at y-y. Unsupported enamel rods between x and y will fall out. Below left: Enamel cleavage followed properly at y-y in cavity wide occlusogingivally. Below right: Threaded metal pins for retention of large amalgam restoration

four times the condensing force of a 2 mm. diameter condenser, and nine times the force of a 3 mm. diameter condenser. Few operators can and will muster enough hand pressure to condense amalgam well with a condenser larger than 2 mm. in diameter. One to 1.5 mm. condensers and a heavy (6 to 8 pound) hand pressure with rapid thrusts will yield a well-condensed amalgam. Mechanical condensers tend to cause landslides of filling material when used for the gingival third region.

Once the walls are covered, the center is gradually filled in. The condenser is stepped over the surface much as for gold foil.[6] Condensing amalgam becomes more difficult as the surface becomes convex. Two instruments then must be used; the larger one in the left hand may support the distal side of the curve, while the smaller condenser in the right hand condenses the mesial side. The positions then are reversed. Landslides of amalgam thus can be prevented even with heavy hand condensation pressure with small instruments.

A gingival cavity with an extremely convex axial wall, such as occurs with annular caries about a clasp-bearing tooth, presents a particular problem for condensation. There are three approaches to this problem:

1. The cavity can be prepared and filled sectionally, leaving bridges of unsound tooth temporarily between the first condensed portions. The recently condensed amalgam is then protected with Copalite varnish. Wherever a new restoration is built in the vicinity of, or adjoining, previous restorations, the varnish is painted over the previous restorations to protect the exterior surfaces from mercury contamination. Then the bridging sections are cut out and filled, making a continuous restoration.

2. The cavity may be completely prepared, and the center portion filled temporarily with cement. After the end sections are condensed, at the same sitting the cement section is burred out and amalgam substituted.

3. For a cavity which is long mesiodistally, such as those joining the proximal portions of a mesioocclusodistal restoration, a matrix strip is useful. The strip is slipped through one proximal contact, around the lingual surface, for a buccal cavity, and through the other contact. The resulting U-shaped matrix is wedged proximally with triangular wedges cut from a round toothpick; then the short free ends are supported rigidly with modeling compound. Both ends of the cavity are filled, condensing the amalgam against the supporting matrix. The convex buccal portion is condensed last, against the very adequate support thus provided.

CARVING THE CONDENSED FILLING

All amalgam fillings should be overbuilt, bringing mercury to the surface of each successive increment. Then they are carved back to finish on well-condensed amalgam. A slight excess bulk should be left everywhere when carving in order to furnish stock for polishing, because carved amalgam always presents a rough, granular surface. Amalgam should not be carved until it is hard enough to resist cutting with a sharp instrument. Well-condensed amalgam can be carved immediately.

Only sharp instruments are used to carve amalgam. Cutting should be in any direction except from the filling toward the tooth. Carving amalgam from the restoration toward the tooth will result in ditched margins. Carving with a dull instrument, or carving amalgam not set enough to resist carving, simulates a burnishing action which breaks down crystallization and brings mercury to the surface. Such a restoration will

6. Markley, M. R. Amalgam restoration for the distal surfaces of cuspid teeth. North-West Den. 32:1 Jan. 1953.

have weak margins and will not hold a polish. Favorite instruments for carving Class V restorations are the hoe-shaped end of the University of Minnesota Walls Carver no. 3, the Hollenback no. 3 carver, kept sharp, and the Woodbury or Baird gold knife with a short, heavy, palm-grasp handle. The back of the blade of the gold knife is ground square to form sharp angles with the sides. It can then be used with a push motion as a trimmer as well as for an excellent carver for gingival and proximal margins.

RESTORED GINGIVAL CONTOUR

The restored gingival shape is very important to the future health of the supporting tissues and to the relative tendency toward recurrent caries. For the young patient and for those having no gingival recession, anatomical form should be reproduced faithfully (Fig. 1). Gingival recession, however, is commonly concomitant with gingival caries and contributes to it, as the nonatomical shape created by recession invites food impaction. Gingival caries contributes to gingival recession, as the unhygienic condition causing the caries may create gingival inflammation and recession of the attachment.

In cases of gingival recession, the cervical bulge should be moved apically (Fig. 5, left and right), to protect the acquired gingival crevice against subsequent food impaction. The shape of the Ferrier type cavity is favorable for reshaping the region. Properly restored gingival contour will sluice the food across the crevice and over the outer surface of the mucosa. It is important that this convexity be restored in a studied manner for every case, a difficult but not impossible task with amalgam.

AMALGAM BASES FOR CAST RESTORATIONS

Amalgam bases should be inserted before teeth bearing gingival cavities are restored with cast gold crowns and so forth. A cement base near the gingival margins of any cemented restoration is a likely source of failure.[2] Percolation soon results in dissolution of cement, and de-

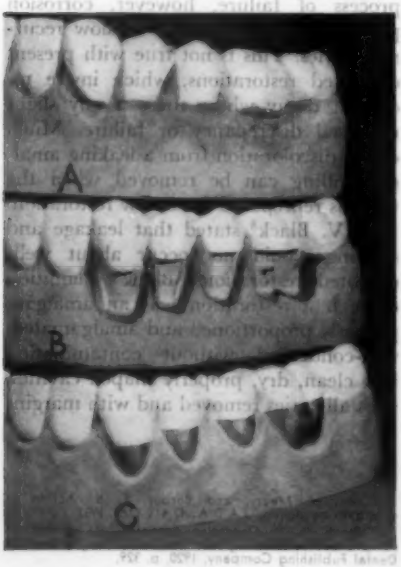

Fig. 5 • Left: Gingival contour modified for cases with gingival recession. A, gingival caries and erosion. B, cavity preparations. Free gingival margin excised to gingival attachment to expose full cavity outline for illustration. C, restorations contoured. Below: Comparative contour for normal gingival attachment at C and for gingival recession at C'.

structive caries follows. Amalgam bases insure the greatest caries resistance for such cases. Gold should completely cover the amalgam where possible, in order to prevent electrolysis.

POLISHING

Schoonover and Souder[5] showed conclusively that all restorations should be finished so as to have no irregular margins or rough surfaces and that the restorations should be polished and kept polished. One or more days elapse after condensation before amalgam is sufficiently crystallized to take and hold a good polish.

At the final appointment, gold knives, dental burs and disks are used to smooth margins and to perfect contour. For the convex surfaces of Class V restorations, a no. 703 tapered fissure bur can be made into a splendid and safe trimming instrument. Mounted in the handpiece, it is rotated with its sharp end corner against a carborundum stone. Then it is tested against a finger nail. When it will no longer scar the nail, the round corner is safe to use as a guide against the cervical portion of the tooth when trimming the excess of gingival filling material and the buccal contour with the sharp lateral blades. Marginal gingival tissue can be pressed back by the rounded end without harm. Since the direction of cutting cannot be from filling to tooth, a bur must be run in reverse for some margins. Once margins and contour are perfected, stiff cone-shaped Robinson bristle brushes charged with very wet pumice will remove the scratches with a minimum hazard of overheating the amalgam. Brushes without mandrels are available to be attached with a screw to the prophylaxis handpiece. Abrasives used for polishing are harmful to the bearings of dental handpieces; therefore, handpieces used for cavity preparation should not be used for abrasives. Final polish is effected with the same type brush and very wet cerium oxide, which is used by lens grinders and available from them or from chemical supply houses.

COMMENT

Amalgam is the least irritating to pulp tissue of all durable materials. A well-made amalgam restoration will not discolor a tooth beyond a possible slight graying near the margins. Varnish will minimize the discoloration.

Massler and Barber[7] recently published disturbing observations on the incidence of staining under amalgam fillings. They found staining under 85 per cent of the 300 teeth examined. It is my opinion that their findings are not an indictment of the material, but of the way it is used. The 15 per cent they found to be without stain possibly represents the small percentage of restorations being properly placed.

If an amalgam restoration is faulty and leaks, it will discolor tooth structure, signaling the need for attention. In the process of failure, however, corrosion products form that block or slow recurrent caries. This is not true with present cemented restorations, which invite recurrent decay where there is any slight marginal discrepancy or failure. Much of the discoloration from a leaking amalgam filling can be removed when the tooth is reprepared for a new restoration.

G. V. Black[8] stated that leakage and staining would not occur about well-executed restorations. Black's definition of such a restoration was an amalgam properly proportioned and amalgamated, well-condensed without contamination into clean, dry, properly shaped cavities, with all caries removed and with margins

7. Massler, Maury, and Barber, T. K. Action of amalgam on dentin. J.A.D.A. 47:415 Oct. 1953.

8. Black, G. V. Operative dentistry, vol. 2, Technical procedures in filling teeth, ed. 4. Chicago, Medico-Dental Publishing Company, 1920, p. 329.

recut after contact with any drug, saliva or other moisture.

Schoonover and Souder[5] found staining to be the result of electrolysis, which was common to leaking fillings having rough margins and surfaces which collected food debris as an electrolyte. They concluded that restorations with tight margins well-finished and polished would not corrode and stain tooth structure if given reasonable mouth hygiene.

Massler and Barber[7] observed that cement bases protected cut dentin against stalning. Cement bases, however, are not the solution to the problem. Black[8] taught that amalgam or any other durable material seated on cement would not resist functional stress. Copalite varnish will seal cut dentin against thermal shock and against staining, without the insecurity common to cement bases.

Amalgam restorations will give a service second only to that of well executed gold foil restorations. Amalgam can be removed and replaced without too much lost effort, if gingival recession continues or if caries recurs. It can be used in regions inaccessible by the gold foil technic. It is a splendid substitute for gold foil where the temperament, time, health or finances of the patient favor this easier, quicker restoration. Under favorable circumstances, including good mouth hygiene, amalgam restorations will give many years of service.

632 Republic Building

Centric relation and mandibular movement

L. E. Kurth, D.D.S., Chicago

By definition the mandible is in centric relation to the maxilla when the condyles are in the most retruded position in the glenoid fossa from which the jaw can make unstrained lateral movements at any given vertical dimension. This position in the edentulous person, as well as in the person with natural dentition, is the position of the mandible at which the teeth of the dentures should come into occlusion. The position of the teeth in occlusion when the mandible is in centric relation is termed centric occlusion or centric position.

Mandibular movement, obviously, is an essential factor in any technic for obtaining centric relation. Consequently in order to recognize and record centric relation, the operator must have a correct concept of mandibular movement.

FACTORS TO BE CONSIDERED IN CHOICE OF TECHNIC

Functional and Nonfunctional Movements • The excursions of the lower jaw can be classified roughly as functional and nonfunctional movements. The functional or chewing movements[1] are the

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1. Kurth, L. E. Mandibular movements in mastication. J.A.D.A. 29:1769 Oct. 1942.

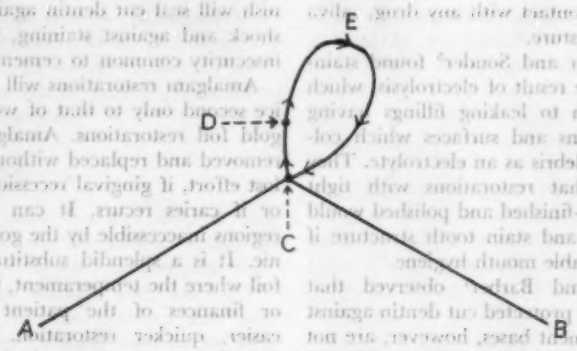


Fig. 1 • Differences between functional and nonfunctional mandibular movements, graphed in horizontal plane at incisor point. Lines AC and BC show location of lateral components of nonfunctional movement. DEC shows direction and location of functional chewing stroke. D indicates approximate location of physiologic rest position

important ones as far as the patient is concerned, for it is during these movements that mastication is accomplished. These movements are of great concern to the dentist also, for it is during function that the greatest amount of stress is applied to the prosthetic restoration. The combination of rotatory and translatory movements of the condyle effects a functional mandibular stroke. The main muscles of mastication cooperate to perform this movement.

Nonfunctional contact movements of the jaw are controlled primarily by the inclined planes of the posterior teeth, the lingual surfaces of the upper anterior teeth and the angulation of the glenoid fossa.

The analogous movement in an edentulous individual is traced by the central bearing screw moving on its tracing plate or by the occlusal surfaces of the biteblocks. The components of this movement are the right lateral, left lateral, protrusive and retrusive movements. Only translatory movements of the condyle are performed in nonfunctional contact movements. The external pterygoid muscle is the primary agent in this movement.

Figure 1 is a diagrammatic interpretation of the great differences between the paths of the functional and nonfunctional movements when they are projected onto the horizontal plane at the incisor point. ACB, the Gothic arch, represents the limits of the nonfunctional movements; DEC represents a functional movement. Centric relation is reached at point C; point D is the approximate location at which physiologic rest position is reached.

It can be seen that the functional chewing stroke takes place posterior to the Gothic arch, which is used to determine centric relation at the accepted vertical opening. This chewing stroke is, of course, contained within similar border movements of the mandible at extended openings, but it is definitely not a border movement. Therefore, the determination of the condylar hinge axis, which is the center for the extreme posterior border movements, can be questioned as a necessary step for the determination of centric relation.

The opening component, always an integral part of the functional movement, is usually lacking in the nonfunctional contact movements. That the Gothic

arch, or needle-point, tracings have been misconstrued by many as representing the true direction of the functional movements of the mandible is most unfortunate. It can be seen that the point designated C in centric relation (Fig. 1) is the only point in common between the functional and nonfunctional movements. Therefore, centric relation can be determined by the use of either a functional or a nonfunctional mandibular movement.

The great majority of the accepted technics utilize nonfunctional mandibular movements; yet centric relation is no more accurate when it is obtained by these methods than when it is obtained by the use of a functional movement, since centric relation is common to both.

Vertical or Axial Force • A study of the physics of mandibular movements reveals that at no time is a true vertical or axial force ever applied by any mandibular restoration in function against a maxillary restoration. Even when the teeth are natural or when there are partial restorations, no vertical or axial forces are ever applied to the abutment teeth in either functional or nonfunctional mandibular movements. This fact is of prime importance and should be remembered in designing partial restorations or in determining the occlusion for complete restorations.

Centric Relation • Centric relation for any patient always has two components, the vertical and the horizontal, which must be determined for the correct positioning of the mandible in the three dimensions of space. The vertical component can be ascertained easily if accurate pre-extraction records are available. The determination of the vertical component for an edentulous patient without pre-extraction records is more difficult.

Physiologic Rest Position • Thompson and Brodie[2] have shown that the physiologic rest position is the most constant position the mandible, with or without teeth, assumes and that it exists for every patient. The vertical component of centric relation measured at the central incisor region is normally about 3 mm. less than the vertical dimension at rest position. The space between the positions centric relation and rest position is called the freeway space or interocclusal gap; when teeth are present, an equal freeway space exists between the anterior teeth at rest position and at centric occlusion.

DETERMINATION OF VERTICAL COMPONENT

When there are no pre-extraction records, the first logical step for the operator is the determination of the physiologic rest position of the mandible. This position can be ascertained by the use of cephalometric roentgenograms, or as it is done more frequently, by estimation of the rest position on the face.

The procedure is as follows: With an indelible pencil a point is marked in the mid-line of the face, on the nose or in the philtrum of the upper lip; and another corresponding point is marked on the chin. With the patient standing erect and unaware of what is being determined, the distance between these two points with the mandible at rest is measured with a ruler or a pair of dividers. It must be emphasized that to achieve any degree of accuracy in this step, the patient's head must be erect, for the mandibular rest position will vary considerably if the head is at an angle, either backward or forward. The head can be maintained in the erect position more easily if the patient is standing erect than if he is sitting in the dental chair.

The patient is told to say "m," "Emma," "a-e-i-o-u," "church," and

2. Thompson, J. R., and Brodie, A. G.: Factors in the position of the mandible. J.A.D.A. 29:925 June 1942.

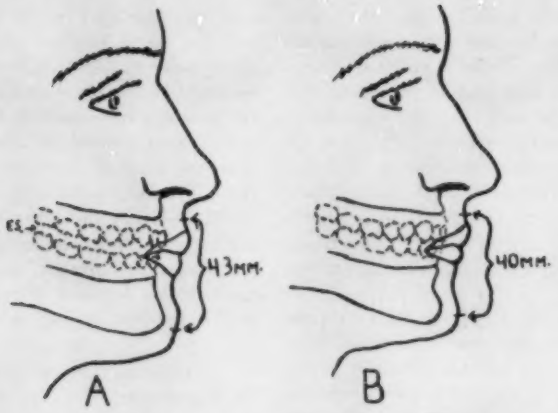


Fig. 2 • Sagittal view. A: Physiologic rest position. B: Centric relation with projected setup in occlusion. Vertical difference in measurements is approximately 3 mm.

then to rest the jaw. In the meantime more measurements are taken between the two points marked on the face. If all the measurements are identical after several trials, it is reasonable to assume that the physiologic rest position of the mandible has been ascertained.

Profile A in Figure 2 graphically portrays the physiologic rest position in the sagittal plane. There is a freeway space between the occlusal and incisal edges of the projected setup. The measurement between the two arbitrarily selected points on the face is 43 mm. Profile B shows the mandibular position of centric relation with the teeth of the projected setup in centric occlusion. The distance between the same two points is now 40 mm.; this distance is the vertical component of centric relation with reference to these arbitrarily chosen points.

It is advisable to check this vertical opening in edentulous individuals before proceeding, especially if a radical change in vertical opening is necessary, and in all cases where a definite rest position cannot be achieved without the use of bite-blocks. The anterior teeth are selected and arbitrarily set to the vertical component determined from the rest position.

When the setups are tried in the mouth, the situation may be as illustrated in Figure 3, above, where the freeway space is still too great. By moving the teeth up and down on one side of the mouth, this gap is closed (Fig. 3, center); the remainder of the anterior teeth are set accordingly until results such as those demonstrated in Figure 3, below, are achieved.

When there is a freeway space of about 3 mm. between the incisal planes, this opening can be accepted as being within physiologic limits. This vertical component will not only be tolerated by the patient, but will place the mandible in esthetic harmony with the remainder of the face. The photographs in Figure 4, left, above and below, show the characteristic facial appearance of a patient whose dentures were made to conform to a vertical component determined with the teeth in occlusion. The lip line is thin and compressed; the labionasal lines are deepened; the nostrils are distended;

and the eyelids seem partially closed. Figure 4, right, above and below, shows the radical change in facial appearance which can be effected by positioning the mandible with the correct physiologic vertical opening.

For elderly debilitated patients who have been wearing old dentures with an excessively large freeway space, it is sometimes foolish to try to achieve a normal freeway space. Invariably a compromise space has to be accepted so that a restoration which can be tolerated is provided for these individuals.

DETERMINATION OF CENTRIC RELATION

Accurately fitting bases for restorations are essential; the accuracy of the registration of centric relation will depend on the accuracy of the adaptation of the bases to the cast and to the patient's alveolar ridges. In the process of adaptation modeling plastic can be added to the maxillary base. The occlusal plane is established on the bite-block by paralleling its occlusal rim with the interpupillary line in the anterior region and with Camper's line (inferior border of the alae of the nose to the superior border of the tragus of the ear) in the posterior region. The median line also is marked on the bite-block and subsequently transferred to the maxillary cast.

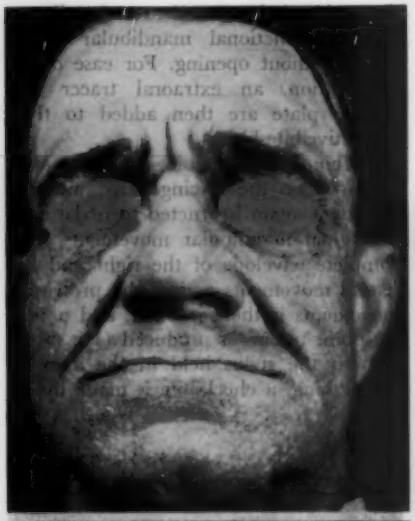
The plate containing the central bearing screw is attached to the biterim in such a way as to maintain the same occlusal plane. A flat plane is attached to the modeling plastic on the mandibular bite-block and made parallel to the maxillary plane. The central bearing screw is then adjusted to the vertical opening component previously determined. The horizontal component is now determined, and centric relation is recorded.

To make certain that there is no interference between the intraoral tracing plates, the bite-blocks are inserted, and the patient is instructed to make all possible nonfunctional mandibular movements without opening. For ease of interpretation, an extraoral tracer and tracing plate are then added to their respective bite-blocks.

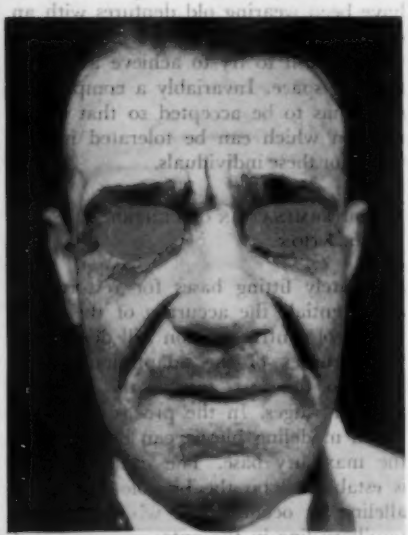
Carbon or a suitable wax or crayon is placed on the tracing plate, and the patient is again instructed to make nonfunctional mandibular movements. The complete envelope of the right and left lateral movements and of the protrusive movements is then graphed, and a needle-point tracing is produced (Fig. 5).

With the stylus held in the apex of this tracing, a check-bite is made by in-

Fig. 3 • Above: Freeway space of more than 3 mm., showing that the vertical dimension of the teeth, selected in tentative setup, was too small. Center: Freeway space reduced by moving teeth in setup on left side. Below: Final physiologic freeway space of 3 mm.



Right: Frontal and sagittal views showing changes in physiognomy achieved by establishing physiologic centric relation and constructing dentures according to this relation



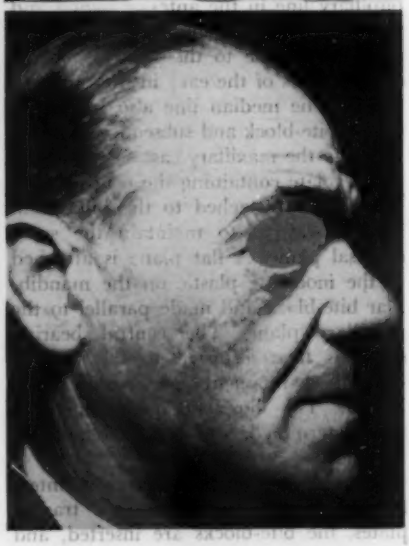


Fig. 4 • Left: Frontal and sagittal views of patient wearing dentures constructed according to a reduced vertical dimension

jecting fast-setting plaster between the intraoral tracing plates. The bite-blocks and the check-bite are removed and carefully luted to their respective casts; they are now ready for mounting on a suitable articulator.

This technic for the checking of centric relation meets all the requirements stipulated in the definition of centric relation. By means of this technic, the mandible is positioned correctly in the three dimensions of space with respect to the maxilla. There are other methods of accomplishing this result, but the fundamentals are identical with those discussed.

This method is basic for obtaining centric relation for almost all prosthetic appliances, for instance, for a complete upper denture with opposing natural teeth or natural teeth and a lower partial denture, or for two partial dentures with free end saddles.

If the patient has one partial denture or two partial dentures, however, and if he has occluding posterior teeth in normal occlusion, then it is preferable to use a functional mandibular movement to ascertain centric relation. In such a case, accurately fitting bite-blocks are constructed on the casts and so adjusted that the modeling plastic is slightly out of occlusion. The patient is instructed to close his remaining teeth into centric occlusion, and this position is registered in plaster.

Centric relation, once obtained, is the starting point for establishing centric occlusion in the prosthetic restorations. Most technics depend on an articulator to meet this objective. It should be remembered that success in determining and planning occlusion, regardless of the theory held, is directly related, not to the instrument used, but to the accuracy of the check-bites obtained from the patient.

Fig. 5 • Extraoral graphing of nonfunctional movement for Gothic arch tracing

SUMMARY

Functional and nonfunctional mandibular movements are entirely different with only one element, centric relation, in common. Centric relation has a vertical and a horizontal component. The vertical component is determined from the physiologic rest position, and the horizontal component is determined graphically by the needle-point technic. When the patient has some remaining teeth in normal occlusion, centric relation can be determined from functional movements.

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Differential diagnosis of dental pain

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An understanding of the phenomena of pain is vitally important in dentistry. Fear of pain keeps many patients from receiving timely dental care. On the other hand, a fair share of patients come to the dental office seeking relief from it. Pain about the face and head is a rather common occurrence. A portion of such pain arises from the teeth or associated tissues. It is the responsibility of the dentist to diagnose and treat all pain of dental origin. In addition he should be sufficiently informed to recognize the probable basis of pain from other causes. In such instances his responsibility terminates when he directs the patient to proper channels for diagnosis and treatment.

Pain is purely subjective and is, therefore, difficult to evaluate accurately. Hardy, Wolff and Goodell[1] held that the experience called "pain" takes into account not only the sensation of pain but also other associated sensations and the emotional state as well. Thus they state that every sensation of pain (ache, prick, burn) is accompanied by a more or less predictable pattern of associated sensations (such as heat, cold, pressure) and feeling states (anger, fear, pleasantness, unpleasantness). The total sensory resultant is the pain experience.

The sensation of pain in contrast to other sensations (touch, heat, cold, pressure) has no organized end organ. Pain sensation is subserved by naked nerve endings. Furthermore, these naked nerve endings do not respond selectively to only one type of stimulus but rather to any type of stimulus (mechanical, chemical, thermal, electrical) provided it has sufficient intensity.[2] The common denominator for stimuli giving rise to the sensation is that they cause or threaten injury to body tissues. Therefore the sensation of pain serves a useful function in that it warns of impending or actual tissue damage.

TYPES OF PAIN

According to location, two types of pain can be identified. Superficial pain originates in the cutaneous regions and deep pain originates in the deep somatic structures or viscera. Each type has its own distinct qualities. Superficial pain has a pricking, bright, burning, itching quality, is highly localizable, and when intense is accompanied both by a quickening of the pulse and a rise in blood pressure. Deep pain tends to be more diffuse, has an aching or sometimes burning quality, is less easily localized, and when severe is accompanied by sweating, nausea, slowing of the pulse, fall in blood pressure and prostration.[2, 3]

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1. Hardy, James D.; Wolff, Harold G., and Goodell, Helen. Pain sensations and reactions. Baltimore, Williams & Wilkins Co., 1952.

2. Best, Charles H., and Taylor, Norman B. Physiological basis of medical practice, ed. 5. Baltimore, Williams & Wilkins Co., 1950.

3. Wolff, Harold G. Some observations on pain. Harvey Lecture Series 39:39, 1943.

Pain impulses travel to the central nervous system by way of the somatic or the autonomic nerves and enter the central nervous system by the lateral divisions of the posterior spinal nerve roots or cranial nerves.

PAIN THRESHOLD

Much experimental study has been made of pain sensations. In such studies, a term commonly used is the "pain threshold," which is the amount of stimulus that will just barely produce a painful sensation of a given quality under standard conditions.[3] The pain threshold in man is remarkably stable and uniform provided standardized methods are used and the subjects maintain an unprejudiced, detached attitude. Under such conditions age, sex, emotional states and moderate fatigue have no material effect on the pain threshold.[4,5] Nevertheless, it is possible to alter the pain threshold by means of suggestion, distraction or other factors which might bias the attitude of the subject.[6] Chapman and coworkers,[7] in a study of 50 psychoneurotic patients and 56 normal control subjects, found that although the psychoneurotic patients required essentially the same amount of stimulus to perceive cutaneous pain, they required a much smaller stimulus to cause a motor withdrawal reaction.

In spite of the constancy in man of the pain threshold under standard experimental conditions, there is, nevertheless, a great difference in the pain experience which will ensue in a particular real life condition. This is primarily related to the emotional state which happens to be associated with the pain sensation. For example, it is common knowledge that an injury which in one individual may produce slight discomfort, will in another who is emotionally conditioned produce excruciating pain. The exaggerated reaction is due primarily to psychic factors and is termed "psychoneurotic pain."

REFERRED PAIN

The observation that pain can be felt in a site other than that whence it originates is of interest clinically. Such a sensation is called "referred pain" and it occurs in tissues supplied by the same or adjacent neural segments. It is often diagnosed incorrectly.

Dental pain arises from a disturbance of the dental pulp, the tissues which surround and support the teeth, and perhaps the temporomandibular joint. Nearly all such pain has a clinically or roentgenographically detectable cause. The dentist should almost always be able to diagnose such pain correctly.

PULPAL PAIN

Pulpal pain arises from nerve fibers within the dental pulp. The only sensory fibers present in the dental pulp are those which give rise to pain and for that reason, regardless of the kind of stimulus, only pain is perceived. The severity and duration of the stimulus modified by the recuperative ability of the dental pulp will determine whether pathologic changes will occur. Sufficiently intense stimuli injure the pulp and precipitate an inflammatory response with resulting pain. Depending on the amount of injury of the pulp, the inflammatory response can be either acute or chronic. The symptoms and microscopic appearance of acute and chronically inflamed pulps differ.

Dental pulps undergoing an acute inflammatory response may be divided into three stages of increasing seriousness:

4. Schumacher, G. A., and others. Uniformity of pain threshold in man. Science 92:110 Aug. 2, 1940.

5. Hardy, J. D.; Wolff, H. G., and Goodell, H. Pain threshold in man. A. Research Nerv. & Ment. Dis., Proc. (1942) 23:1, 1943.

6. Wolff, H. G., and Goodell, H. Relation of attitude and suggestion to perception of and reaction to pain. A. Research Nerv. & Ment. Dis., Proc. (1942) 23:434, 1943.

7. Chapman, William P., and others. Measurements of pain sensitivity in patients with psychoneurosis. Arch. Neurol. & Psychiat. 57:321 March 1947.

physiologic hyperemia, pathologic hyperemia, and inflammation. The progressive course through the three arbitrary divisions usually produces a gradual change of symptoms from one stage into the next. The history of total symptoms from the beginning stage to the acutely inflamed state is fairly characteristic. The findings in each of the three states of the dental pulp are presented in Table 1.

Chronically inflamed pulps usually are only annoying or moderately painful. There are two types: ulcerative and hyperplastic. Chronic ulcerative pulpitis may be the sequel of an acute pulpitis. In most instances it results from a slowly progressing carious exposure of the dental pulp. Chronic hyperplastic pulpitis occurs in some deciduous and incompletely formed permanent teeth. This may be associated with an abundant

Table 1. • Acute pulpal conditions giving rise to pain

	Physiologic hyperemic pulp (not exposed)	Pathologic hyperemic pulp (usually not exposed)	Inflamed pulp (may or may not be exposed)
Etiology	Irritation (especially in close proximity to the pulp) 1. Chemical—Silver nitrate, formaldehyde solutions, synthetic porcelain and cement liquid, some types of acrylic fillings, etc. 2. Thermal shock—Too rapid cutting, large metal restorations, excessively hot foods or liquids 3. Mechanical—Extensive exposure of dentin	Irritation 1. Same factors as for physiologic hyperemic pulp except that irritation is more severe and of longer duration 2. Sequel of uncorrected physiologic hyperemic pulp	Irritation 1. Infection of exposed pulp 2. Sequel of pathologic hyperemic pulp
Character and duration of pain	Sharp, shooting, lancinating pain on stimulus. Pain ceases usually within seconds on removal of stimulus	Sharp, shooting, lancinating pain on stimulus. Pain lingers (seconds or minutes) after removal of stimulus. Pain more severe than preceding stage	Intense, throbbing, intermittent to constant pain
Response to thermal change	Very sensitive to heat and cold	As condition progresses cold tends to relieve and heat to aggravate	Heat aggravates and cold relieves
Response to percussion	None	None	At first not tender, later tooth may be slightly tender
Electric pulp test	Hypersensitive	Hypersensitive in early phases	Usually hyposensitive
Roentgenogram	Negative	Negative	Possibly slight periapical radiolucency
Pathology	Dilation of blood vessels	Early inflammatory changes: dilation of blood vessels, edema, presence of polymorphs	Late inflammatory changes: Disintegration of pulp tissue, pus formation
Treatment	Eliminate irritation, antiseptic anodyne dressing (zinc oxide plus eugenol) and protection of tooth	1. Extraction of tooth 2. Root canal therapy (eugenol sealed over exposure to give relief)	1. Extraction 2. Root canal therapy (nick pulp with explorer, to relieve congestion and seal* phenol compound to give relief, if this fails, remove pulp at once)

*Phenol compound: Menthol 1.3 Gm.; thymol 2.6 Gm.; phenol 12.0 Gm.

Table 2 • Chronic pulpal conditions which may give rise to pain

	Inflamed ulcerative pulp	Hyperplastic pulp
Etiology	1. Chronic infection of exposed dental pulp 2. Sequel of acute pulpitis	Chronic inflammation of pulp exposed by caries in deciduous or recently erupted teeth. Occurs only if pulp has abundant blood supply and great vitality
Character of pain	1. Occasional dull throbbing pain lasting several minutes 2. Pain most apt to occur with hot food or beverages and when exercising 3. Direct pressure on exposed pulp causes pain 4. When not disturbed tooth usually not painful	1. Painful only when injured or probed
Response to thermal change	Hypersensitive	Insensitive
Electric pulp test	Hyposensitive	Markedly hyposensitive
Roentgenogram	Often slight periapical radiolucency	Negative
Pathology	1. Partially necrotic pulp. Necrosis in coronal portion of pulp with increasing vitality toward apex 2. Degenerative changes such as pulp stones	Protruding pulpal mass consisting of granulation tissue covered by epithelium
Treatment	1. Extraction 2. Root canal therapy	Extraction unless it is a permanent tooth with root ends almost completely formed

blood supply. Table 2 lists the diagnostic features for the two divisions.

The absence of tactile sensibility in the dental pulp often makes localization of pulpal pain difficult and misleading. The pain is often referred to another region of the jaw, the opposing jaw, or even to a part of the face not related to the teeth. It, however, always remains on the same side from whence it originates. By careful clinical examination, history, diagnostic tests and roentgenographic interpretation, the offending tooth usually can be found.

Response to the electric pulp tester is by no means an absolute criterion of the state of the dental pulp, but is a fairly reliable index of the presence or absence of gross pathology. A tooth which fails to respond is usually nonvital. Response usually indicates vitality but this is not always true. For example, a tooth which contains liquefied pulpal material may respond as if it were vital. This is due to conduction of the electrical stimulus to the periapical region by means of the liquid contents of the pulp cavity. Response within or beyond the usual normal range is at best only indicative in a general way of the state of the pulp. For example, pulpal tissue in which a cellular pathologic condition is present can respond within fairly normal range if the nerve elements are still sufficiently intact; on the other hand, a normal pulp well insulated by secondary dentin may require considerably more electrical stimulus to respond. The only conclusion which can be reached by the use of the electric pulp tester is that failure of a tooth to respond usually indicates a nonvital pulp while response usually indicates a vital pulp which may be normal or pathologic.

Other tests should be used in conjunction with the electric test in the diagnosing of pulpal disease in suspicious teeth. The thermal response is apt to be more reliable. Heat may be applied by means of a balled mass of hot gutta-

Table 3 • Acute traumatic periodontal injuries giving rise to pain

Etiology	Character of pain	Treatment
Accidents—bumps, blows	Severity and character of pain varies with the type of injury to the periodontium. Tooth will feel numb, or will be tender to percussion with or without mobility	Depends on type of injury to periodontal tissues and tooth 1. If injury is minor, soreness and tenderness will disappear with time and rest. If injury is more severe, pulp may become devitalized 2. If tooth is displaced or loose-splinting 3. If tooth is fractured—rest, splinting, root canal therapy, or extraction, depending on location of fracture and pulp involvement
Injury to periapical region from root canal therapy—overmedication, overfilling, instrumentation beyond apical foramen, irritating medicaments, etc.	Tooth may feel sore, elevated, tender to percussion with or without mobility	Prevent further injury to periapical region. Soreness and tenderness will disappear
Excessive occlusal stress—high restoration, biting into cherry pit, etc.	Tooth will feel sore or tender to percussion with or without mobility	1. Relieve cause of trauma 2. Rest
Injury to periodontium from dental operations—malleting gold foil, separation of teeth, etc.	Tooth will feel sore or tender to percussion with or without mobility	1. Periodontium will recover with time and rest 2. If pulp is devitalized by injury—root canal therapy or extraction

percha. Caution should be exercised not to apply too much heat suddenly. Cold may be applied by holding a piece of ice against the tooth. Adjacent teeth and the corresponding tooth on the opposite side should be used as controls. A tooth with a vital pulp will respond to both heat and cold with a transient sharp, shooting pain. An unusually prolonged painful response indicates abnormality. Failure to respond on repeated and prolonged application of heat or of cold denotes a nonvital pulp.

PERIODONTAL PAIN

Periodontal pain arises from a disturbed periodontium. Periodontal membrane and alveolar bone may be disturbed by chemical, traumatic, thermal or bacterial injury. Periodontal pain may be classed in two divisions, that due to noninfective injury and that which results from infective injury. The usual causes, symptoms and treatment of noninfective injury to the periodontium are listed in Table 3.

Invasion by pathogenic microorganisms or their products causes the second class of periodontal pain. The microorganisms gain access through the periodontal pocket or the apical foramen (from an infected pulp). The former results in a lateral or interradicular abscess while the latter becomes a periapical or dentoalveolar abscess. The inflammatory reaction following the infective injury, therefore, will be on the lateral aspect of the tooth in the bifurcation area or at the root end. The listing in Table 4 of the periodontal conditions of infective origin that give rise to pain will help the dentist to make a correct diagnosis.

Periodontal pain, especially that resulting from an invasion of the apical periodontium, sometimes may be confused with pulpal pain. Table 5 will help when making a differential diagnosis of pulpal and periodontal conditions that give rise to pain.

OTHER SOURCES OF PAIN

Submerged or impacted teeth can sometimes cause facial pain. This is probably due in most instances to pressure against an adjacent nerve or tooth. In some instances, an impacted tooth can cause resorption and pulp exposure of the tooth with which it is in contact. The pain under these conditions is similar to that in any other tooth with a vitally exposed pulp. Pain from submerged teeth is usually of a referred type. Roentgenographic findings are of great value in making a diagnosis.

Exposed dentin, especially in the cervical region, may make the tooth unusually sensitive to thermal and chemical stimuli. Desensitization of the dentin with such agents as 20 to 40 per cent silver nitrate solution followed by eugenol, 40 per cent aqueous zinc chloride solution and by 33 per cent sodium fluoride desensitizing paste will give relief. Several applications of the medication may be necessary. If dentin is exposed

Table 4 • Periodontal conditions of infective origin giving rise to pain

	Apical region of tooth	Lateral or interradicular region of tooth
Etiology	Invasion of apical periodontium by pathogenic microorganisms from infected root canal	Invasion of lateral or interradicular aspect of roots by pathogenic microorganisms from infected periodontal pocket
Character of pain	Dull, steady ache	Dull, steady ache
Pyrexia	1. Elevation of temperature 2. Patient appears toxic	Usually temperature not elevated
Lymph nodes	Usually enlarged and tender	May or may not be involved
Swelling	1. At onset there is only erythema over apical mucosa 2. Swelling and cellulitis later	Swelling in localized area
Extrusion of tooth	Extruded	Not extruded
Pulp test	No response	Tooth responds (unless by coincidence it is nonvital)
Color of tooth	Discoloration and loss of translucency	Normal translucency and color
Percussion of tooth	Extremely painful (in early phase pressure by biting on tooth seems to give relief)	Not painful or only slightly painful to percussion (pressure by biting on tooth sometimes gives relief)
Roentgenogram	1. Negative in early stages (unless there was a pre-existing granuloma) 2. Later stages show widening of periodontal membrane in periapical region	Periodontal pocket which may contain calculus
Treatment	1. In early stages open tooth for drainage 2. In later stages, if there is fluctuation incise for drainage 3. Prescribe rest, liquids, analgesics 4. Prescribe antibiotics if indicated 5. After acute symptoms have subsided, root canal therapy or extraction	1. Obtain drainage by gently prying crest of gingiva away from tooth 2. Irrigate periodontal pocket 3. Apply antibiotic paste or ointment inside periodontal pocket 4. After acute symptoms subside, perform gingivectomy or extract tooth

Table 5 — Differential diagnosis between pulpal and periodontal conditions giving rise to pain

	Pulpal condition	Periodontal condition	
		Periapical (dent.-alv.) abscess	Lateral or interradicular abscess
Character of pain	1. Sharp, shooting, lancinating or throbbing 2. Tends to be intermittent in nature 3. Often more severe in reclining position	Dull, continuous, pulsating. Position of body has no influence	Dull, continuous, pulsating. Position of body has no influence
Localization	Difficult	Easy	Usually easy
Thermal response and electric pulp test	Hypersensitive or hyposensitive	No response (pulp nonvital)	Normal response (pulp vital)
Response to percussion	Not tender	Very tender	Not tender or slightly tender
Extrusion of tooth	None	Extruded (except in earliest stage)	Usually not extruded
Discoloration and loss of translucency	None	Discoloration and loss of translucency	None
Lymph nodes	Negative	Usually enlarged and tender	May or may not be involved
Roentgenogram	Essentially negative	Periapical radiolucency if tooth is extruded or if there was pre-existing granuloma	Evidence of periodontal pocket

by erosion it may be necessary to make a cavity preparation and restoration to eliminate the sensitive region.

"Dry socket" or alveolar osteitis is a condition which sometimes follows extraction of a tooth. It occurs when the blood clot or granulation tissue in the alveolus becomes infected and disintegrates. The unprotected alveolus is noxiously stimulated and gives rise to pain which has a dull, nagging, constant and radiating character.

Disturbances of the temporomandibular joint are too many and varied to be discussed in this paper. They can cause pain which may be referred to almost every part of the head. The usual symptoms consist of pain in and about the ears, head, side of the neck, pain on opening the mouth, and a burning sensation of the tongue and throat.

SUMMARY

1. An understanding of the phenomena of pain is of vital importance to the dentist. The experience which the patient calls "pain" is complex and takes into account the sensation of pain, other associated sensations, and various feeling states.

2. Pain sensation is subserved by naked nerve endings which are capable of responding to any stimulus sufficiently intense to cause or threaten injury to tissues.

3. Two types of pain can be identified, each of which has its own distinct qualities. One of these is superficial pain originating in the cutaneous regions, while the other is deep pain originating in the deep somatic structures and viscera.

4. The ability to perceive pain from an experimentally applied stimulus is remarkably stable in man, provided the subject maintains an unprejudiced and detached attitude. Such factors as age, sex, emotional states and moderate fatigue have little influence on the pain threshold.

5. In a particular real life condition, the total pain experience of an individual is noticeably influenced by his emotional state.

6. The dentist should be able to diagnose and treat all pain arising from disturbances of the dental pulp, the tissues which surround and support the teeth, and probably, also, the temporomandibular joint.

7. Pulpal pain is caused by stimulation of nerve fibers within the pulp. Sufficiently intense stimuli injure the pulp and precipitate an inflammatory response which may be acute or chronic in nature. The clinical symptoms as well as the microscopic appearance vary with the type of inflammation.

8. Periodontal pain arises from injury of the periodontal tissues and may be classed according to cause into that due to infection and that due to acute trauma.

9. Submerged or impacted teeth, exposed dentin, alveolar osteitis or dry socket, and disturbances of the temporomandibular joint are other sources of pain.

The dentist's income tax

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In the January 1954 issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, a broad résumé was presented of the same subject to be discussed herein. Since so much of the subject was covered last year, it may seem a bit repetitious to take up the income tax problem again this year.

But the new year always brings some new tax problems, and this past year, especially, has introduced many changes —since the signature by the President of the new Internal Revenue Code of 1954 in August. The new code embodies more than 3,000 changes in the basic tax law and, in fact, constitutes the most sweeping revision of the tax structure in many years. Although there has been an attempt at simplification, the mere fact of change often leads to some complications.

It is impossible, of course, in the scope of one short article, to take up more than a few of the more important changes; however, those items which may have some especial relevance to the dentist's return will be discussed.

An important change which affects everyone is the new filing date—April 15—which gives an additional month's leeway for the preparation of the return.

Member of Illinois and U.S. Supreme Court bars; trust officer, Lake Shore National Bank.

As is always the case, full advantage will be taken by many of this provision. Actually it may be preferable to avoid the hustle and bustle of last minute deadlines by getting the return in early, thus disposing of last year's affairs before the new year is well along. The Treasury Department has recognized the advantage of early filing by granting to those who desire to use it, the option of filing a final return in lieu of the final quarterly installment of the Declaration of Estimated Tax, and if the option is used, the deadline filing date is January 31 instead of the January 15 installment date.

In this connection, it should also be pointed out that a much more stringent enforcement of the requirement of the filing of the Declaration of Estimated Tax is currently in the offing. The requirement is not new; however, through lack of popular understanding, many persons have failed to comply. In the case of dentists, because their income is not generally subject to the withholding tax, a declaration is required if gross income from all sources exceeds $600 per exemption plus $400. For the comparatively few dentists whose income is largely salary and therefore subject to the withholding tax, a declaration is only required if gross income exceeds $5,000, or if a joint return is filed with the wife, if the combined gross income exceeds $10,000. The Declaration of Estimated Tax is to be made in any case on Form 1040-ES, and the first payment is due on April 15. Subsequent payments are due on June 15, September 15 and January 15. Penalties accrue not only for failure to file the declaration or to pay the tax on the due dates, but also for significant underestimation of the amount of tax due. However, if the estimate is based on the previous year's tax, no penalty will accrue. A sizeable difference, on the other hand, between an estimate for the coming year and the income reported for the preceding year may require some explanation.

The present Code has made no sweeping changes in the exemption provisions. Full income-splitting is still allowed as between man and wife, which means of course that joint returns by spouses still generates a considerable saving in most cases. The "head of household" provisions also give a partial benefit where there is no spouse but where there are family dependents, such as an aged parent or children.

The personal exemption is still $600 per person, with additional exemptions of $600 for persons over 65, and for blind persons. This same exemption applies to each additional person qualified as a dependent. A nonrelative can qualify as a dependent if he is a member of the household and the taxpayer's home is the dependent's principal residence; for a close relative, over one-half support by the taxpayer qualifies him automatically as a dependent. The income test, (requiring a dependent's gross income to be under $600) is abolished with respect to any child under 19, or who, for over five months during the year was a student in a recognized school. This is a great improvement over last year's situation and that of previous years, when college students home on summer vacation had to be very careful to avoid earning over $600 because of the danger of parental loss of an exemption.

Another innovation in the new tax law is the dividend exclusion of $50 and the dividend credit of 4 per cent. Previously no credits have ever been allowed. This has resulted in considerable objection being raised by investors about the injustice of double taxation because, of course, a dividend received is the result of profits in the corporate organization which have already been taxed in the corporation's return. The new credit is a small but welcome gesture in the opposite direction. Schedule J, on the back page of Form 1040, provides for this exclusion and credit. It should be noted that for 1954 the exclusion of $50 may

be applied to dividends received prior to July 31, 1954 so far as possible, and any balance to dividends received thereafter, but the 4 per cent credit may only be applied to dividends received after the July 31 date, and after the exclusion has been applied, and is further limited to 2 per cent of taxable income. In general, stock dividends are not includable as taxable income. Final total taxable dividends are to be entered in Schedule A on page 2 of Form 1040 after Schedule K is completed.

The most vital part of the income tax return for most dentists is the separate Schedule C, headed "Profit (or Loss) From Business or Profession." This schedule constitutes a one page summary of net professional earnings for the year. Unless, for some special reason, an accrual basis has been decided on, the figures used in this schedule should represent actual amounts of cash received or paid out during the year. Hence uncollected fees should not be reported; on the other hand, no deductions can be taken for bills accrued, unless they are actually paid within the year. Line 1 on the schedule is the total receipts or gross professional income item. Since dentistry is not a business involving the sale of merchandise, Lines 2 through 10 should be left blank, and Gross Profit, (Line 11), is therefore the same amount as total receipts (Line 1). Some dentists are misled by line headings and attempt to deduct among these items, salaries paid to nurses, cost of materials and other expenses. Actually, these expenses in the case of professional men come under "Other Business Deductions," and are listed under Lines 12 through 22.

The first item here, on Line 12, is salaries, and here the dentist's nurse's salary and that of any other assistants is listed. Salaries paid to any of the dentist's children or his wife for services, if actually rendered, are deductible, but if the dentist files a joint return with his wife, her income so paid must, of course, be included. The next item, rent on business property, includes the rent which the dentist pays for his office. If the office is in the residence of the dentist, a fair proportion of the rent paid may be allocated to the office and deducted as a proper business expense. The number of rooms used for professional as against residential use is an acceptable ratio in most cases.

If a dentist owns the property in which he maintains his office, other deductions accrue. If the entire building is used for his professional work, the entire amount of mortgage interest (Line 14), real estate taxes (Line 15), depreciation (Line 18), repairs (Line 19) and other business expenses, such as cleaning, heating, utilities and insurance (Line 22) may be deducted by listing the full total of such expenses in the appropriate lines, with itemized explanations as to depreciation, repairs and miscellaneous expenses listed in Schedules C-1 and C-2 at the bottom of this schedule. If the entire building is not used for the dentist's own professional work, these expenses should be prorated, and an amount reasonably allocable to the part used for these purposes is in each case deductible.

In addition to the important items deductible in connection with occupancy, there should be added into these "Other Business Deduction" lines other items. In the tax line (Line 15), for example, Social Security taxes paid on employees should be included, as well as gasoline and auto license taxes to the extent that the car is used for professional purposes and state taxes on material purchased for professional use. Casualty losses of property used in practice of the profession are deductible in Line 16, to the extent not compensated for by insurance. There is also the item for bad debts, but this does not include uncollected fees which have never been reported as income. Normally cost of materials used professionally are included in Line 22, as other business expenses.

Depreciation and obsolescence can be charged as a deduction against the cost of all dental equipment, instruments and furniture, in amounts which amortize cost over the period of useful life. A new method of accelerating depreciation is permitted under the new code for all assets acquired after December 31, 1953. By this new method, when the number of years of useful life has been determined, the first year's depreciation is that fraction of total cost in which the numerator is the digit representing the final year, (that is, if useful life is ten years, digit 10) and the denominator is the sum of the digits for all years (that is, if useful life is ten years, 10 plus 9 plus 8, and so forth, or 55). Thus, in the example used, with a useful life of ten years, a depreciation deduction in the first year after acquisition may be taken of 10/55ths, and so on. This accelerates depreciation write off of equipment considerably, since 27/55ths, or about one-half of the total cost, is depreciated in the first three years.

For most furniture or dental equipment, an arbitrary figure of ten years for useful life is used. A longer period applies to buildings, often 30, 40 or 50 years, depending on the type. Land cannot be depreciated, so its value should be subtracted when determining the cost basis of a building. Automobiles are generally depreciated over a four year period with a salvage value at the end of the period. When reporting depreciation on dental equipment, dentists are permitted to use the "composite" method grouping the cost of all equipment acquired at the same time.

It should be noted that all of the above deductions are for items directly related to the dentist's profession or property used in connection with it. Although some of the same rules apply, similar deductions to be applied to business property owned but not used in connection with the dentist's professional occupation are not reported in this Schedule C, but instead in Schedules F and H on page 2 of Form 1040.

The final catchall of professional expense deductions is Line 22, Other Business Deductions. In addition to the expenses already mentioned as allocable here, this is the place to list the following expenses: cleaning, insurance, telephone, uniforms, laundry, postage, printing, cost of reception room magazines, light and gas bills, cost of collections, entertainment done solely for the promotion of practice, drugs and medications, laboratory fees, dental mechanic's fees, repairs to equipment, supplies, equipment useful for less than one year, fees for professional assistance, expenses of travel to dental conventions or meetings outside of home county, accounting fees, collection fees, membership fees and dues for dental associations and any other items of expense in the production of the dentist's professional income.

The above deductions are added together and subtracted from the "Gross profit" figure to arrive at "Net profit" (Line 24). This need not be entered in the self-employment tax computation, but should merely be transferred to the Schedule C Summary on page 2 of the form. The Report of Self-employment Income on page 3 and the computation of self-employment tax directly above are not applicable to dentists because they are not included within the Social Security law, and this part of the dentist's return should therefore be left blank.

The capital gains and losses schedule, Schedule D, is little different from previous years, and should offer little difficulty. The tax has, however, been reduced from 26 per cent to 25 per cent, it should be noted.

The remainder of the 1955 tax return relates to nonbusiness deductions for contributions, interest payments, taxes, medical and dental expenses, child care, casualty losses, and certain other special payments, such as alimony. The general deduction for contributions should not

exceed 20 per cent of adjusted gross income, but a special additional deduction has been granted in the new code amounting to an additional allowable 10 per cent for contributions solely to schools, hospitals and churches. The interest deduction is largely the same as in past years, except that where formerly only actual interest charges stated were allowed when buying on the installment plan, the new method permits deduction of carrying charges on installment purchases to the extent of 6 per cent of the average unpaid balance, whether stated or not.

The tax deduction remains as before, and includes state income taxes, auto license, state gas taxes and other state taxes not otherwise deducted in the return. Medical and dental expense not compensated for by hospital, health or accident insurance, are again deductible, also, but only the excess over 3 per cent of the dentist's adjusted gross income. This compares with 5 per cent last year. This deduction also has a top limit of $2,500 per dependent and taxpayer. The "child care" deduction is new and applies only to expenses up to $600 by a widow or widower if the care is to enable the taxpayer to be gainfully employed. The Miscellaneous grouping is the final item of nonbusiness deductions. This includes special deductions, such as alimony, the taxpayer's share of the real estate taxes and the mortgage interest of a cooperative apartment, investment counsel fees, the rent of a safety deposit box and other nonclassified items.

When these deductions have been added, if the total does not exceed 10 per cent of the Adjusted Gross Income, the dentist should use the standard deduction, 10 per cent. If it exceeds 10 per cent, it should be entered in the Tax Computation schedule, and the instructions should be followed. The net result of this computation is the tax.

When the tax is computed, the dentist should deduct payments made in his quarterly installments, and he will have either the final amount still due, or the amount of refund due him by the government.

The changes mentioned here are but a few of the many alterations in the new Revenue Code, but cover, in the main, those which the dentist with a normal return might encounter.

Although the tax return still remains a headache for the average taxpayer, the Form 1040 becomes a little more familiar every year, and if the changes noted herein are taken into consideration in the preparation of this year's return, it should not present too great a difficulty to the average dentist taxpayer.

605 North Michigan Avenue

Destiny of Science • It is the great destiny of human science, not to ease man's labors or prolong his life, noble as those ends may be, nor to serve the ends of power, but to enable man to walk upright, without fear, in a world which he at length will understand and which is his home. *P. B. Sears, "Charles Darwin," 1950, p. 118.*

Prevention of rheumatic fever and bacterial endocarditis

The American Heart Association, through its Committee on Prevention of the Council on Rheumatic Fever and Congenital Heart Disease, recently has revised its recommendations for the prevention of subacute bacterial endocarditis. The full statement, entitled "Prevention of Rheumatic Fever and Bacterial Endocarditis Through Control of Streptococcal Infections," published in the February 1955 issue of *Circulation,* is available in leaflet form from the American Heart Association, 44 East Twenty-third Street, New York 10, N. Y. Section four of the statement deals specifically with prophylactic methods to be used by the dentist against bacterial endocarditis. Entitled "How the Dentist Can Protect His Patients Against Bacterial Endocarditis," the information is printed in chart form. The suggestions in this chart are substantially the same as those previously published by the Council on Dental Therapeutics of the American Dental Association and carried on page 65 of the 1955 edition of *Accepted Dental Remedies.* Drug combinations other than those suggested in the chart are available for this purpose, but the procedures described here are believed suitable for general use. Copies of the chart may be obtained from the American Heart Association or from any of its local offices. The text of the dental statement is as follows:

Penicillin • Penicillin is the drug of choice for administration to patients with rheumatic or congenital heart disease undergoing dental manipulations or surgical procedures in the oral cavity. Although the exact dosage and duration of therapy are somewhat empirical, there is some evidence that for effective therapeutic prophylaxis reasonably high concentrations of penicillin must be present at the time of the surgical procedure. The dosage regimens employed for long-term prophylaxis of rheumatic fever are inadequate for this purpose. There is reason to believe that continuous maintenance of penicillin in the blood over a period of several days will result in the death of those organisms which have lodged in the heart valve during the period of transient bacteremia. Not only should penicillin prophylaxis be designed to afford maximum protection, but the method must also be practical. In general, the parenteral route of administration is preferred. All patients should be instructed to report to their physician or clinic should they develop a fever within a month following the operation.

Dosage • Six hundred thousand (600,000) units of aqueous penicillin and 600,000 units of procaine penicillin in oil containing 2 per cent aluminum monostearate administered intramuscularly 30 minutes before the surgical procedure.

As an alternative, although considered less desirable, penicillin may be administered by the oral route in dosages of 250,000 to 500,000 units one-half hour before each meal and at bedtime, beginning 24 hours prior to the operation and continuing for five days. At the time of the surgical procedure it is advisable to give an additional 250,000 units.

Contraindications • Patients who give a history of sensitivity to penicillin.

Other Antibiotics • The broad spectrum antibiotics should be employed as prophylaxis in patients who are sensitive to penicillin or in those who are undergoing surgery of the urinary or lower gastrointestinal tract. Oxytetracycline, chlortetracycline, or erythromycin should be administered in full dosage for five days, beginning treatment the day prior to the surgical procedure.

Cases and Comments

ALVEOLAR EXTENSION OF THE MAXILLARY SINUS

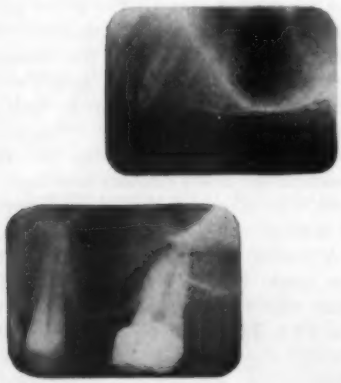
By Cyril B. Kanterman, D.D.S., Uniontown, Pa.

Extension of the maxillary sinus well into the alveolar process is not uncommon in cases of advanced alveolar resorption. In those mouths which have been edentulous for a long period of time, the crest of the alveolar ridge sometimes recedes until it is in close approximation to the floor of the maxillary sinus (illustration, above). These cases, however, are but examples of simulated sinus extension, since the condition is due to alveolar resorption rather than to actual extension of the maxillary sinus.

True extension of the maxillary sinus into the alveolar process may be found where there has been little or no resorption of the alveolar process. Thus, this anomaly can be seen in nonedentulous mouths. In pronounced cases, the sinus floor may dip down almost to the crest of the ridge (illustration, below).

This anatomic variation of the maxillary sinus is of practical importance to the dentist. Because of the close relation between the antrum and the alveolar process in these cases, the extraction of upper posterior teeth may be complicated by possible perforation of the sinus or even tearing out of the sinus floor. To prevent accidental entry into the sinus and the formation of antral oral fistula, the surgical removal of teeth is indicated. Here again the necessity of preoperative roentgenograms is emphasized.

95 East Fayette Street



Above: Advanced resorption brings crest of alveolar ridge in close approximation to floor of maxillary sinus. Below: Actual extension of maxillary sinus, no alveolar resorption present

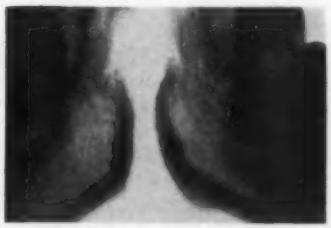
CONGENITAL NONUNION OF THE MANDIBLE

By C. E. Crandell, D.D.S., Southport, N. C.

A 10-year-old negro boy was admitted to this office for the extraction of lower first molars. Examination revealed a congenital nonunion of the mandible at the symphysis. A mid-line cleft of the lower lip and an ankyloglossia were present at birth, but these defects were corrected early in life. Mild caries existed; no other defects were noted. The patient is able to masticate well and apparently lives a normal life. He states that he is teased a lot, but no psychiatric disturbances were noted.

The medical history revealed that in September 1950, incision and drainage was done on a tonsillar abscess. Of four siblings, the boy is the second child and the first male. The other children are normal. The patient is being referred for possible surgical correction of the anomaly.

212-214 Howe Street



Congenital nonunion of the mandible

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

The ages of dentists, 1954

In determining present and future availability of dental services, information on the age distribution of dentists is of prime importance. Such information is urgent in the study of ways to meet the dental manpower requirements of the Armed Forces. Data on ages of dentists are necessary in the interpretation of statistics on the age and cause of death of dentists. Population projections indicate that the United States population may be more than 200 million by 1970,[1] the present age curve of dentists is a basic factor in determining the number of additional graduates needed to keep pace with the rapidly expanding population.

The age distribution fluctuates from time to time, mainly because the number of dental graduates varies. For instance, the low number of graduates in the 1930's and early 1940's is now reflected in a relatively low number of dentists between the ages of 35 and 50.

The statistics in this study are based on a sample consisting of every fourth dentist listed in the alphabetical file of all dentists maintained by the Association's Directory and Membership Records Department. This file lists all dentists whether or not active in the profession. The data were collected in September 1954 and recorded on punch cards to facilitate analysis. The size of the sample was 24,000 dentists.

The mean age of all dentists was 47.9 and the median was 47. For active members of the Association the mean was 45.0, for life members 73.6, and for nonmembers 54.1 (Table 1). The graph shows the percentage of all dentists in each ten year age group, according to membership status. Included among the nonmembers are many dentists who have retired. The standard deviation of ages of all dentists was 13.8.

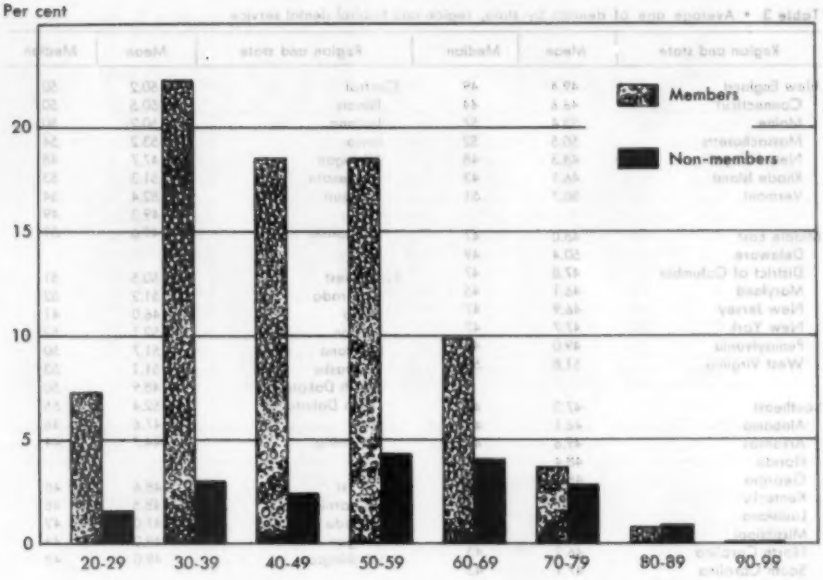
A similar study of the ages of dentists was made in 1949.[2] At that time the mean was 48.1 and the standard deviation 13.4. The relatively large number of

Table 1. Percentage distribution of dentists by age, according to membership

Age	Members			Nonmembers	All dentists
	Active	Life	All members		
-24	.6	.0	.6	.7	.6
25-29	8.8	.0	8.4	7.5	8.2
30-34	16.4	.0	15.5	9.8	14.4
35-39	12.6	.0	12.0	6.2	10.9
40-44	11.6	.0	11.0	5.8	10.0
45-49	12.6	.0	12.0	7.0	11.0
50-54	12.2	.0	11.6	9.8	11.2
55-59	11.9	.0	11.3	12.8	11.6
60-64	8.5	.0	8.0	11.8	8.8
65-69	3.0	25.1	4.1	9.6	5.2
70-74	1.2	34.9	2.9	8.2	3.9
75-79	.4	25.8	1.7	6.4	2.6
80-	.2	14.2	.9	4.6	1.6
Total	100.0	100.0	100.0	100.0	100.0

1. Illustrative projections of the population of the United States, by age and sex: 1955 to 1975. Bureau of the Census, Series P-25, No. 78, Aug. 21, 1953.

2. American Dental Association, Bureau of Economic Research and Statistics. Ages of dentists in the United States. J.A.D.A. 40:107 Jan. 1950.



Percentage distribution of dentists by age groups according to membership status, 1954

graduates during recent years may account for both the slightly lower mean and the higher standard deviation in 1954 as compared to 1949.

Although the mean age of dentists in 1954 was practically the same as the 1949 mean, the distribution in 1949, as shown in Table 2, was considerably different from that of 1954. In the latter year, 14.4 per cent of the dentists were in the age group 30 to 34, compared to only 10.4 per cent in 1949. Whereas 26.7 per cent of the dentists in 1949 were in their forties, only 21.0 per cent were in that age bracket in 1954.

The mean age of dentists by state showed considerable variation, with a low of 44.4 in Virginia and a high of 53.4 in Maine (Table 3). The regions ranked as follows with respect to mean age of dentists: Northwest (50.5); Central (50.2); New England (49.4); Far West (48.6); Middle East (48.0); Southeast (47.3), and Southwest (46.9). Generally, it may be said that the average age of dentists tends to be highest in the north central part of the country and lowest in the southern part. The age distribution of dentists by region and for

Table 2 • Percentage distribution of dentists by age in 1949

Age	Per cent
-24	4
25-29	7.3
30-34	10.4
35-39	10.9
40-44	13.0
45-49	13.7
50-54	13.6
55-59	10.6
60-64	6.8
65-69	5.3
70-74	4.4
75-79	2.3
80-	1.1
Total	100.0

Table 3 • Average age of dentists by state, region and federal dental service

Region and state	Mean	Median	Region and state	Mean	Median
New England	49.4	49	Central	50.2	50
Connecticut	46.6	44	Illinois	50.5	50
Maine	53.4	57	Indiana	50.2	50
Massachusetts	50.5	52	Iowa	53.2	54
New Hampshire	48.3	48	Michigan	47.7	48
Rhode Island	46.1	43	Minnesota	51.3	53
Vermont	50.7	51	Missouri	52.4	54
			Ohio	49.3	49
Middle East	48.0	47	Wisconsin	49.6	51
Delaware	50.4	49			
District of Columbia	47.8	47	Northwest	50.5	51
Maryland	46.1	45	Colorado	51.2	52
New Jersey	46.9	47	Idaho	46.0	41
New York	47.7	47	Kansas	52.1	52
Pennsylvania	49.0	49	Montana	51.7	50
West Virginia	51.8	53	Nebraska	51.1	53
			North Dakota	48.9	50
Southeast	47.3	45	South Dakota	52.4	55
Alabama	46.1	42	Utah	47.6	46
Arkansas	49.6	47	Wyoming	44.7	44
Florida	48.4	47			
Georgia	48.8	47	Far West	48.6	48
Kentucky	50.0	48	California	48.5	48
Louisiana	47.9	46	Nevada	47.0	42
Mississippi	48.9	47	Oregon	49.0	49
North Carolina	46.2	43	Washington	49.0	48
South Carolina	47.1	43			
Tennessee	44.8	43			
Virginia	44.4	40	Army	37.0	36
			Navy	33.9	31
Southwest	46.9	46	Air Force	33.0	31
Arizona	45.1	42	Veterans Administration	45.3	45
New Mexico	45.6	42	Public Health Service	37.2	33
Oklahoma	50.8	50			
Texas	46.1	45	United States	47.9	47

the federal dental services may be found in Table 4. Dentists in the federal dental services are, of course, considerably younger than other dentists. The mean age of dentists in the Army was greater than that of dentists in the Navy and Air Force. The average age of dentists in the Veterans Administration did not differ greatly from the general average.

Table 5 shows the separate age distributions for men and women dentists. Enrollment of women dental students has been down in recent years and this is reflected in the age distribution of women dentists. The mean age of women dentists included in this study was 50.2 compared to 47.8 for men. As shown in Table 6, women dentists have tended to locate in the East and the Far West to a greater extent than men dentists.

The age at graduation of dentists graduating during five-year periods since 1910 is shown in Table 7. The increasing age at graduation was very gradual until the last five-year period, 1950-1954, when it jumped to 28.2 from the previous high of 25.8. This sharp increase resulted, of course, from the influx of students whose study had been postponed by the war. A factor in the steadily increasing age at graduation has been the increasing amount of predental work required.

Table 4 • Percentage distribution of dentists by age, according to region

Age	New England	Middle East	South-east	South-west	Central	North-west	Far West	Federal dental services
-24	.2	.3	.4	.6	.3	.1	.2	3.9
25-29	6.0	6.6	8.8	8.1	6.1	7.2	6.4	27.3
30-34	14.2	12.2	17.5	17.5	12.2	16.5	14.9	21.6
35-39	11.7	11.8	12.0	10.7	9.0	7.7	10.6	14.3
40-44	9.6	11.6	10.2	10.6	8.4	4.9	9.4	14.5
45-49	8.6	12.7	8.6	10.4	11.8	9.7	11.2	8.9
50-54	9.9	12.4	9.7	10.9	12.2	10.2	13.0	4.9
55-59	13.2	12.5	9.0	10.1	14.3	12.5	11.3	2.3
60-64	11.2	9.2	8.2	9.1	9.4	10.5	9.2	1.8
65-69	5.7	4.3	6.2	4.6	6.1	9.9	4.8	.5
70-74	5.0	3.0	5.0	4.1	4.7	4.9	4.4	.0
75-79	2.7	2.2	2.8	2.3	3.3	3.8	2.8	.0
80-	2.0	1.2	1.6	1.0	2.2	2.1	1.8	.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5 • Percentage distribution of dentists by age, according to sex

Age	Male	Female
-24	.6	.9
25-29	8.2	7.9
30-34	14.5	8.3
35-39	10.9	11.0
40-44	10.0	9.2
45-49	11.0	7.9
50-54	11.3	9.2
55-59	11.5	20.6
60-64	8.8	8.8
65-69	5.1	5.7
70-74	3.9	5.7
75-79	2.6	2.2
80-	1.6	2.6
Total	100.0	100.0

Table 6 • Percentage distribution of dentists by region, according to sex

Region	Male	Female
New England	7.5	8.4
Middle East	29.2	40.0
Southeast	12.3	8.8
Southwest	4.7	3.4
Central	28.3	21.2
Northwest	5.2	2.4
Far West	12.8	15.8
Total	100.0	100.0

Table 7 • Percentage age distribution at graduation of dentists graduating in five-year periods since 1910

Age at graduation	Year of graduation								
	1910-1914	1915-1919	1920-1924	1925-1929	1930-1934	1935-1939	1940-1944	1945-1949	1950-1954
-20	3.1	2.7	.6	.4	.5	.3	.3	.0	.0
21	9.5	10.5	4.8	3.3	.9	.6	.5	1.4	—
22	14.0	17.7	12.7	12.6	4.6	5.6	3.3	8.4	.5
23	14.1	17.7	18.9	17.8	15.9	15.5	16.0	19.6	2.1
24	15.1	13.3	15.4	17.2	21.6	20.7	21.3	20.1	7.2
25	11.7	8.1	12.1	13.9	18.6	17.9	17.8	14.8	10.5
26	8.9	8.8	9.8	8.8	12.2	13.5	13.6	7.7	13.6
27	5.3	5.6	7.4	6.7	7.9	8.6	9.1	6.2	14.3
28	5.3	4.2	6.3	5.3	6.0	5.0	5.8	5.1	11.7
29	3.2	3.0	3.4	3.4	3.2	3.1	3.8	3.1	11.4
30	3.2	1.7	2.1	2.5	2.1	1.8	2.6	2.4	7.4
31	2.4	1.4	1.7	2.7	1.9	2.2	1.2	2.1	6.0
32	1.1	1.0	1.2	1.4	1.3	1.2	1.5	1.4	5.1
33	.9	.9	.9	1.3	.7	1.0	.6	1.4	3.1
34	.5	1.2	.6	.8	.8	.8	.9	1.4	2.3
35-	1.7	2.2	2.1	1.9	1.8	2.2	1.7	4.8	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean age at graduation	24.8	24.6	25.1	25.2	25.5	25.6	25.6	25.8	28.2

Although the mean age at graduation during 1950-1954 was 28.2, more of the graduates were 27 years of age than any other age, followed closely by the 26-year-olds. The mean is brought up by the relatively few students at ages well beyond the "normal" age for dental students, including 4.8 per cent 35 years of age and older. From 1930 through 1949 the modal (most common) age at graduation was 24 and during the twenties it was 23.

In future years the *American Dental Directory* will include the year of birth for all dentists for whom this information is available. This will facilitate future studies of the age of dentists and will make possible age breakdowns by geographic areas smaller than states.

B. Duane Moen, Director

COUNCIL ON DENTAL THERAPEUTICS

Council announces classification of additional products

The classification of products by the Council on Dental Therapeutics has been described in a previous report (J.A.D.A. 40:489 April 1950). The Council's program now provides for classification of products in Group A, Group B, Group C and Group D. Products are reconsidered periodically, and decisions are subject to change at any time that a substantial amount of new evidence becomes available. The files of the Council contain information on many drugs and dental cosmetics, and inquiries are welcome.

GROUP A

Listing of products in Group A means that at the time of their consideration, the items conformed with the provisions for acceptance established by the Council on Dental Therapeutics and adopted by the Board of Trustees and the House of Delegates of the American Dental Association. Items in this group will be listed in *Accepted Dental Remedies* and may use the Seal of Acceptance, unless otherwise provided.

The following additional products are classified in in Group A:

Eugenol, U.S.P. (See A.D.R. ed. 20, p. 52)

Eugenol, U.S.P. (Ethical Dental Products Co.): A brand of eugenol, U.S.P. In bottles, 1 and 4 ounces.

Eugenol, U.S.P.-Excelsior Brand (Irving Penchuk Dental Supply Co.): A brand of eugenol, U.S.P. In bottles, 1 and 4 ounces.

Eugenol, U.S.P. (Guterman Dental Supply Co.): A brand of eugenol, U.S.P. In bottles, 1 and 4 ounces.

Calcium Hydroxide Suspensions (See A.D.R. ed. 20, p. 129)

Pulpdent Paste (Brand of Calcium Hydroxide Paste) (Rower Dental Mfg. Corp.): Stated to contain 52.5 per cent of calcium hydroxide suspended in an aqueous methyl cellulose solution. (See report on page 335.)

Pulpdent Liquid (Brand of Calcium Hydroxide Suspension) (Rower Dental Mfg. Corp.): Stated to contain 8.7 per cent of calcium hydroxide suspended in an aqueous methyl cellulose solution. Pulpdent Liquid is a thin suspension that can be applied to the pulpal wall of cavity preparations and to the exposed pulp. It hardens quickly in air and calcium hydroxide paste may be placed over it if desired. It has been recommended for use as a cavity liner, especially under dental cements, because of the ability of the calcium hydroxide to neutralize free acid from the cement.

GROUP B

Listing of products in Group B means that there is insufficient evidence to justify their present acceptance, but there is reasonable evidence of their usefulness and safety. These products meet the other qualifications and standards established by the Council on Dental Therapeutics. It is the Council's opinion that Group B products may be promoted for special use and study.

The Council's initial consideration of products which may be eligible for Group B listing is influenced favorably by the knowledge of further investigations then in progress. It is the policy of the Council to reconsider Group B products each year on the basis of new evidence which may be produced in their support. Classification in this category is not ordinarily continued for more than three years.

GROUP C

Listing of products in Group C means that the evidence is so limited or inconclusive that the products cannot be accurately evaluated. It is the Council's opinion that Group C products require further study by qualified investigators.

The following additional product is classified in Group C:

Heliogen Brand of Chloramine-T-Potassium Iodide Tablets (Heliogen Products, Inc.): (See report on page 336).

GROUP D

Listing of products in Group D means that they are unacceptable because of their demonstrated inability to meet the standards outlined in the provisions for acceptance.

Council reclassifies Pulpdent Paste (brand of calcium hydroxide paste)—Rower in Group A

Pulpdent Paste (brand of calcium hydroxide paste)—Rower was previously classified in Group B (J.A.D.A. 45:214 Aug. 1952).

Evidence in the form of photomicrographs of sections from teeth treated with the calcium hydroxide paste was submitted by the firm in support of its request for Group A classification of the product. In the opinion of the Council, this evidence further demonstrates the safety and usefulness of the product. The Council believes that the evidence for the usefulness of calcium hydroxide in pulp capping has now been substantiated by extended clinical experience.

The product is now packaged in polyethylene tubes in order to avoid the hardening phenomena that were observed with the wax-lined metal tubes.

The Council therefore reclassifies Pulpdent Paste (brand of calcium hydroxide paste)—Rower from Group B into Group A.

Council reclassifies Heliogen brand of chloramine-T—potassium iodide tablets in Group C

A previous Council action in classifying Heliogen Tablets in Group D (J.A.D.A. 46:334 March 1953) was based on two main considerations: (1) the lack of evidence in support of the usefulness of the product, and (2) the objectionable characteristics of the labels and claims in advertising.

The product was reviewed recently, in the light of new information submitted by Heliogen Products, Inc. Studies have been reported which relate to the bactericidal properties of various forms of iodine.[1,2] Limited clinical reports which have been made available by the firm suggest that favorable results were obtained with the product under certain conditions.[3] Another preliminary investigation, however, failed to demonstrate any significant clinical superiority of the product over placebo tablets.[4,5]

The Council believes that the evidence presented for the clinical usefulness of the product is still inconclusive. The Council recognizes, however, that the manufacturer is making efforts to obtain additional information in support of the preparation. The Council further acknowledges the cooperative attitude of the firm in revising its advertising material and labels to conform to higher standards.

In view of the foregoing considerations, the Council has voted to classify Heliogen brand of chloramine-T—potassium iodide tablets in Group C. In keeping with Council policy, the product may be reviewed at any time that a substantial amount of new evidence becomes available.

1. Gershenfeld, Louis, and Witlin, Bernard. The bactericidal efficiency of Heliogen. Am. J. Pharm. 125:129 April 1953.

2. Gershenfeld, Louis, and Witlin, Bernard. Further studies on the antibacterial efficiency of Heliogen. Am. J. Pharm. 125:258 Aug. 1953.

3. Berliner, Abraham, and Carroll, Benjamin. A clinical investigation of the effects of aqueous iodine solutions. (Unpublished report on file in the Council office.)

4. Kutscher, A. H. Lack of effectiveness of a dilute iodine solution in the treatment of gingivitis, pericoronitis and recurrent aphthous stomatitis. J.A.D.A. 49:63 July 1954.

5. Kutscher, A. H. Studies of dilute iodine solution still in progress. J.A.D.A. 49:257 Aug. 1954.

BUREAU OF LIBRARY AND INDEXING SERVICE

The American Dental Association Film Library

The following films which were shown on the annual session motion picture program in Miami have been added to the Film Library and are now available at a nominal rental fee of $2.50 to dental societies, study clubs, dental schools, hospital dental staffs, and armed services dental personnel. Since the number of prints of each title is necessarily limited, it is suggested that program chairmen plan their programs far enough in advance to insure availability.

FILMS RECEIVED

Cancer of the Oral Cavity • (Kinescope or film record of live television program) 16 mm., color, sound, approximately 60 minutes total showing time for Parts I and II. Produced in 1954 by the American Cancer Society and the Columbia Broadcasting System. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago, and from the American Cancer Society. Purchase ($180) from the American Cancer Society, 47 Beaver St., New York 4.

The role of the dentist in the recognition of oral cancer is discussed and the manifestations of oral cancer are emphasized in order to promote earlier diagnosis and adequate treatment, thereby increasing the curability rate. (Suitable for general practitioners, hospital dental training staffs and dental study clubs.)

Pressure Steam Sterilization • 16 mm., color, sound. Produced in 1953 by the Society of American Bacteriologists under the sponsorship of the American Sterilizer Co., Erie, Pa. Technical production by Sturgis-Grant Productions, Inc. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago, and from the Society of American Bacteriologists, University of Pennsylvania School of Medicine, Philadelphia 4. Purchase ($185) from the American Sterilizer Co., Erie 6, Pa.

The operation of a modern autoclave is demonstrated in detail. The importance of moist steam in the destruction of microorganisms is shown, and the shortcomings of dry heat sterilization are discussed. The medical aspect is stressed, but it can easily be made to apply to dentistry as well. (Suitable for general practitioners, hospital dental training staffs and other professional groups.

Restorative Dentistry • 16 mm., color, magnetic sound, 30 minutes. Produced in 1954 by Ray E. Stevens, Jr., D.D.S. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago. Purchase ($195) from Dr. Stevens, 2000 Davidson Ave., S., Grand Rapids 7, Mich.

The preparation of a gold inlay using the hydrocolloid-stone die technic are demonstrated. (Suitable for dental students and general practitioners.)

Gateway to Health • 16 mm., color, sound, 20 minutes. Produced in 1953-54 by John Ott Pictures, Inc., Winnetka, Ill., for the National Apple Institute and for Fred D. Miller, D.D.S. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago, and on free loan (limited supply) from the National Apple Institute. Purchase ($134.50) from the National Apple Institute, 726 Jackson Pl., N.W., Washington 6, D. C.

How proper diet, toothbrushing and adequate dental care help to prevent dental caries is shown. (Suitable for use in intermediate grades in schools and up, for community and civic groups and for parents' groups.)

An Indirect Inlay Technique • 16 mm., color, sound, 14 minutes. Produced in 1954 by Linus C. Fitzgerald, D.D.S. Technical production by Cascade Film Co., Calif. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago. Purchase from Dr. Fitzgerald, 450 Sutter St., San Francisco.

The standard hydrocolloid indirect technic used in the preparation of bridges and complex multiple restorations is demonstrated by means of animated drawings. (Suitable for

dental students, general practitioners and dental study clubs.)

FILM REVIEW

Immediate Endodontics and Periapical Surgery • 16 mm., color, sound, 30 minutes. Produced in 1954 by John I. Ingle, D.D.S., University of Washington School of Dentistry with the cooperation of E. R. Squibb & Sons. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago, from the University of Washington School of Dentistry ($1.00) and from E. R. Squibb & Sons (free loan), 745 Fifth Ave., New York 22.

This film, which demonstrates a technic of rapid root canal therapy and periapical curettage, opens by showing the patient who has a periapical granuloma at the apex of an anterior tooth. The steps involved in the endodontic treatment are shown, including the placement of the rubber dam and the type of instruments used. Animated drawings are used to illustrate the removal of debris from the canal.

The periapical surgery, which is performed at the patient's second visit, are illustrated fully, beginning with the administration of the anesthetic and ending with the giving of postoperative instructions to the patient.

The film is well organized and the photography is excellent. The intraoral close-ups enable the viewer to observe all the steps clearly. The detailed procedures shown and the use of roentgenograms and animated drawings add to the film's instructional value. It is suitable for dental schools, general practitioners, dental staffs, Armed Forces personnel, oral surgeons and endodontists.

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LON W. MORREY, D.D.S., EDITOR
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Editorials

Annual confectionery sales not sweet say market research experts

According to a recent report of the Market Research Division of the National Association of Tobacco Distributors,[1] the nation's sweet tooth is turning sour—sour, that is, to America's candy and confectionery manufacturers and others interested in that industry.

Nineteen hundred and fifty-three marked the second consecutive year in which the candy and confectionery sales in the United States failed to keep pace with the country's population and economic growth. The survey shows that although the retail sales level of such products approximated $1,627,000,000 in 1953, the per capita consumption dipped to $10.11, which figure represents a drop of 2.3 per cent from the 1952 rate and is approximately 5.7 per cent lower than the per capita consumption rate of 1951. Stated differently, these data indicate that the average American ate 45 cents less sweets in 1953 than in 1952 and 61 cents less than in 1951. This continuing drop denotes a loss in potential sales of more than $95,000,000 from the nation's 1951 confectionery consumption level and approximately $60,000,000 from the level of 1952.

Although a decrease of 45 cents in the annual consumption of confectionery may seem minor, percentagewise it represents a loss of no mean proportion. Furthermore, a loss in per capita consumption of $0.61 over a two year period may indicate that at last the American public is beginning to take the subject of nutrition, and particularly the consumption of carbohydrates, seriously. If such is the case pessimistic dentists and other skeptical health workers who deplore man's apparent inability to change his dietary habits may have cause to change their minds. This much seems certain: if the

trend of the last two years continues, more and more people will be less and less exposed to the dietary factors that predispose to dental decay.

Just what influence members of the dental profession and others interested in health have had in bringing about this slight change in America's dietary habits cannot be measured, although the researchers who conducted the study from which these data were taken place a goodly share of the blame on the shoulders of dentists and nutritionists. Failure of the confectionery industry to capitalize on its sales potential, say those researchers,[1] is attributable in part to:

> Increased opposition of quasi-official scholastic [sic] and parent groups to the unrestricted sale of candy and confectionery products.
>
> Unprecedented growth of diet fads, increased consumer adherence to special dieting practices and changed eating habits.
>
> Uncounteracted consumer acceptance of distorted impressions concerning the alleged, but unsubstantiated, harmful effect of candy and confectionery products on teeth and general health.

If these premises be true, it behooves every member of the dental profession to weigh the loss which his attitude on nutrition has caused the country's confectioners against the benefits which have accrued to American children.

1. Goldstein, Hardon E., and Kolodny, Joseph. Candy and confectionery sales in the United States—1953. Market Research Division, National Association of Tobacco Distributors, 200 Fifth Ave., New York 10, 1954.

Crusade for Freedom seeks truth dollars to lift the Iron Curtain

The recent Russian upheaval is an indication that all is not well, socially and economically, behind the Iron Curtain. How much of that internal disorder is the result of poor planning and poor administration and how much is the result of external influences exerted by noncommunist nations remains for historians to tell. In the meantime the cold war continues.

High on the list of weapons used by democratic peoples against communism is an educational program called Radio Free Europe sponsored by the Crusade for Freedom. The Crusade for Freedom was wholeheartedly endorsed by the House of Delegates of the Association in 1952. Radio Free Europe consists of a network of 29 powerful radio transmitting and relay stations in West Germany and Portugal which broadcasts news from the free world to the communist shackled states of Czechoslovakia, Poland, Hungary, Rumania and Bulgaria. Good shows, good music, religious programs and news are broadcast to these five countries for as much as 20 hours a day. Messages of freedom also are carried to the 70,000,000 citizens of those nations by means of thousands of balloons airborne over and behind the Iron Curtain.

It is estimated that at least 80 per cent of the people living in those Soviet-captured countries are opposed to their communist regimes. As long as that opposition is kept alive, as long as the captives continue to wish and work for freedom, their captors will be prevented from completely absorbing them and from absorbing West Europe.

Because of America's increasing interest in the Radio Free Europe program, its sponsor, The American Heritage Foundation, has extended its 1955 fund-raising drive through March and April. This extension will enable every American dentist who is

interested to participate in this world battle for men's minds. Active participation need consist of no more than sending a contribution now to the Crusade for Freedom, in care of your local postmaster. Each truth dollar contributed will pay for one hundred words of truth over Radio Free Europe. The sooner the truths of democracy fully penetrate behind the Iron Curtain the sooner the curtain will be lifted.

Need for additional research in periodontics recognized by American Public Health Association

Dentists are not alone in their concern over the problems of periodontal disease. That other health specialists are also interested is evidenced by a resolution adopted by the American Public Health Association at its eighty-second annual meeting last October. The governing body of that organization, recognizing the prevalence of periodontal diseases and the probable relationship between periodontal infection and systemic disorders, recorded their concern[1] as follows:

"Resolved, that the American Public Health Association goes on record as urging dental schools, the National Institute of Dental Health and other such agencies as may be interested in such health problems [periodontal diseases] to develop and support the immediate promotion of research on methods of prevention and control and on the epidemiology of periodontal diseases."

For years the dental profession has been indebted to its allies in the health field for their support and cooperation in efforts to establish preventive dental programs, public dental health programs and more recently programs of water fluoridation. Dentistry appreciates the present expression of interest in problems associated with periodontal diseases by its allied professional workers.

Certainly now that researchers have found in fluoridation a partial solution to the problem of dental caries they should be stimulated to turn to research in other fields of dentistry, especially to those diseases which affect the soft tissues of the mouth. Dental researchers must utilize and expand the ever-increasing knowledge of histochemistry, biochemistry, enzymology, cellular physiology and biophysics in order to bring diseased conditions of the soft tissues of the oral cavity under control. The role of oral microorganisms in the disease must be thoroughly studied. Fundamental processes governing the activities of living oral tissues must be investigated. Research must be made into the organic composition of the cell and in the processes that govern cellular activity under normal conditions and in periodontal diseases. Studies should be conducted on the influence of vitamins, trace elements, protein balance, fatty acid metabolism and carbohydrate metabolism on oral tissues. Truly the need for uncovering full information on the etiology, prevention and treatment of periodontal diseases is great and the potential benefits of such knowledge to the public are vast. Any aid which the dental profession may receive from its allied professional workers that will hasten the fulfillment of such objectives will be welcome.

1. Resolution attention to periodontal disease. Am. J. Pub. Health 44:1610 Dec. 1954.

Washington News Letter

Washington is paying increased attention to dental manpower problems. The subject will come into sharp focus this spring, with Congress having to make decisions on extension of the doctor-draft law and on numerous bills which are intended by their sponsors to benefit the healing arts professions in one way or another.

As in medicine, there are sharp differences of opinion on Capitol Hill—as well as among the professions themselves—as to whether dentists should be subject to two draft laws; on the existence of an actual shortage of dentists nation-wide; on the wisdom of federal financial assistance to dental schools and their students; on the efficiency of the Armed Forces in their utilization of dental officers.

DENTAL MANPOWER

The most recent official pronouncement on the subject of dental manpower is in the form of a statistical report compiled and published by the Health Resources Advisory Committee to the Office of Defense Mobilization. In the matter of professional supply, it takes a pessimistic view but makes no recommendations for remedial action.

"We of this Committee," the report says, "are gravely concerned with the quantity and quality of health services in this country. We feel bound to look not only at the present but also at the future and at the factors that are now deciding the future. The first of these factors is the expense in time and money required of whoever chooses to enter medicine or dentistry. . . . There are no short cuts or substitutes.

"The burden of 22 or 24 years of financial outlay for either dentistry or medicine gives us real concern. Medicine (or dentistry) may, so to speak, price itself out of the market by losing its appeal to a considerable group of young men."

Following are some of the figures and observations relating to dentistry which are presented in the advisory committee's report:

In the U.S. today there are approximately 94,000 dentists, of whom 85,000 are active; about 75,000 in private practice. In military service are 6,300, and some 1,300 are employed by Veterans Administration, U. S. Public Health Service and state and local health departments.

At the present graduation rate, the number in active practice will be about 90,000 but "this predicted increase will not be sufficient to maintain dentist-population ratios at the current level."

Noting that the Army, Navy and Air Force probably will continue to need two dentists per 1,000 strength, the report states: "It would seem that the question is not whether the military can profitably use dentists at this level, but the effect of their withdrawal on the civilian health and the availability of dentists in the civilian population to maintain such staffing levels."

Staffing difficulties of the dental schools are recognized as being the result of relatively low salaries and doctor-draft attrition, for the most part.

In conclusion, the report says: "If full mobilization should bring a total of 24,000 dentists into the Armed Forces, the civilian supply would again drop to levels comparable to those of the last war, with a drop of 25 per cent in relation to 1950. Because the dentists are relatively an older group than physicians, with a much greater concentration in the ages over 50, the drop in the effective supply of this profession might conceivably be considerably greater since older dentists in general carry smaller workloads."

BILLS AFFECTING DENTISTRY

The Administration's national health program makes no provision for federal aid to relieve the financial burdens of dental schools or promote matriculation of students through scholarships. However, members of Congress have introduced bills which bear directly or indirectly on the dental manpower situation. The Burnside-Anfuso bill, for example, authorizes 150 million dollars over a five year period for grants to expand and improve existing schools of medicine, dentistry, nursing and public health. The Hill-Priest bill calls for a 30 million dollar, three year program of construction grants to dental and other professional schools, as well as hospitals, for construction and equipment of research facilities.

Among other proposals under consideration are military medical and dental scholarships, civilian scholarships and outright governmental subsidies to professional schools in the health sciences. In addition, there is the Administration's bill for improving health

services for dependents of military personnel, which is expected to be taken up in the near future by the Senate and House Armed Services Committees.

Section 11 of the dependents' care bill deals with dental services and says in part:

"Except outside the continental limits of the United States and in remote areas within the continental limits of the United States where adequate civilian dental facilities are not available, dental treatments for dependents of members of the Armed Forces will be restricted to emergency dental care and dental care as a necessary adjunct to medical or surgical treatment.

"Emergency dental care is defined as the care required to relieve pain and suffering and shall not include any permanent restorative work or dental prosthesis."

ARMED FORCES APPOINTMENTS

Recent personnel changes in the military establishment include appointment of a new chief of the dental division in the Navy's Bureau of Medicine and Surgery and designation of a deputy to Frank B. Berry, M.D., Assistant Secretary of Defense for Health and Medical Affairs.

Rear Admiral Ralph W. Malone succeeds Rear Admiral Daniel W. Ryan as assistant chief of the Bureau of Medicine and Surgery and head of its dental division. The latter will relieve Rear Admiral Herman P. Riebe in April as inspector of dental activities on the West Coast. Admiral Riebe will report to Washington in May to become general dental inspector, the post relinquished by Admiral Malone.

Dr. Berry's new deputy is Edward A. Cushing, who served several years ago as assistant chief medical director of the Veterans Administration, in charge of educational and research activities. He is scheduled to assume office in March.

In the Army Surgeon General's Office, Capt. Harry T. Winkler has reported for duty as administrative assistant in the dental division. His previous post was administrative assistant in the dental sciences department, Medical Field Service School, Brooke Army Medical Center.

INTRODUCE BILLS TO EXTEND SPECIAL DRAFT, MODIFY MILITARY DEPENDENT DENTAL CARE; BUDGET BOOSTS DENTAL RESEARCH

Bills have been introduced in Congress to implement the President's health message delivered before the nation's lawmakers January 31. The American Dental Association is meeting with government officials and will testify before Congressional committees on those aspects of the health program which affect dentistry. On February 12 and 13 the Council on Legislation, under the chairmanship of Paul E. Jones, met to discuss the federal legislative calendar and to plan Council activities relating to it. Of special interest to the dental profession are measures relating to the physician-dentist draft law, the Veteran Administration's dental care program, dental care for dependents of military personnel and budget provisions for dental research.

PRESIDENT ASKS EXTENSION OF DENTIST-PHYSICIAN DRAFT

An administration bill extending the dentist-physician draft law for two years has been introduced in the House of Representatives by Rep. Vinson (D., Ga.). The bill makes no change in the present law, including the system of priorities, other than to change the termination date. However, there is no provision for extending the $100 a month special pay for dental or medical officers entering service after June 30. The Department of Defense has indicated, however, that the special monthly pay will be treated within two separate legislative proposals.

The Association is on record opposing continuation of the special draft law and has recommended extension of the special compensation for dental officers. Representatives will testify on the proposed measure during the next months.

In February, Association officers and Council representatives conferred with Pentagon officials on the draft. Representing the Association were President Daniel F. Lynch; F. J. Reichmann, chairman of the Council on Federal Dental Services; J. Claude Earnest, vice-chairman of the Council on Legislation; C. Willard Camalier, assistant secretary, and Bernard J. Conway, secretary of the Council on Legislation.

Speaking for the Department of Defense, Frank Berry, M.D., assistant secretary of defense for health and medical affairs, stated that the Department hoped it would not be necessary to use the special draft mechanism for obtaining dentists but believed that the law should in any event be enacted as a standby measure for use in case of emergency. Representatives of the Department of Defense will be invited to discuss the matter further at the March meeting of the Council on Federal Dental Services.

BILL LIMITS DENTAL CARE FOR MILITARY DEPENDENTS

A second administration bill introduced in the House increases medical care for dependents of military personnel but sharply limits dental care. The bill limits dental care to emergency treatment and to care regarded as a necessary adjunct to medical or surgical treatment. Emergency treatment is defined as "that care required to relieve pain and suffering and does not include any permanent restorative work or dental prosthesis." An exception to the limitation is made

for dependents outside the United States and in "remote areas" of the U. S. The bill follows closely recommendations made previously by the Association to the Department of Defense.

BUDGET BOOSTS FUNDS FOR VA AND USPHS DENTAL PROGRAMS

Funds for the dental activities of the Veterans Administration outpatient program and for dental research of the U. S. Public Health Service have been increased in the President's proposed budget for the 1956 fiscal year.

Under the budget, the "hometown" phases of the VA's outpatient dental program would receive $11,500,000, an increase of $300,000 over the 1955 fiscal year. The VA's proposed budget anticipates a drop-off of dental patients in the outpatient program. A major part of this program is to be handled on a fee-for-service basis. Total treatments are anticipated at 133,000 out of which 98,000 would be on a fee-for-service basis.

The operation of the VA's outpatient dental program was the subject also of a recent Presidential order. Beginning February 1, only peace-time veteran benefits will be available to persons who enter service after that date.

The order, which will eventually cause a substantial reduction in the extent of dental services furnished by the VA, provides that peace-time veterans may receive dental benefits only if the defect is disabling as well as service-connected. Exception is made for two groups of men: those discharged prior to February 1 who served in World War II or the Korean conflict, and men now in active service who may receive benefits after discharge provided the dental defect occurred before February 1. For these two groups, the defect need not be disabling but must still be service-connected.

Earmarked for dental activities of the U. S. Public Health Service is a sum of $2,136,000, an increase of $146,000 over the current appropriation. Nearly all of the increase is for direct research operations in the National Institute of Dental Research. The 1956 budget proposes an allotment of $764,000 for direct research as compared with the $620,000 appropriated for 1955. Other proposed expenditures are as follows: $521,000 for research grants and fellowships (no change over 1955 appropriation), $12,000 for review and approval of grants (an increase of $1,000), $660,000 for technical assistance to states (no change), $110,000 for coordination and development of resources (no change), and $69,000 for administration (a $1,000 increase).

REINSURANCE, MORTGAGE LOAN INSURANCE IN OMNIBUS BILL

An omnibus health bill, introduced to implement the President's special health message, contains provisions for reinsurance of private health insurance plans, a section on mortgage loan insurance for construction or expansion of hospitals and convalescent homes and a change in the pattern of making grants to states for public health programs.

The reinsurance program has as one of its objectives stimulating private health groups and commercial carriers to extend their coverage to farm families and low income groups. Last year the House defeated a similar measure.

Under the new bill, eligibility for mortgage loan insurance is extended beyond the provisions of a similar bill introduced in 1954 in that, in addition to operators of nonprofit enterprises, operators of proprietary, profit-making hospitals, diagnostic and treatment (including dental) centers and licensed convalescent homes would be eligible for loan insurance.

The change proposed in the grant-in-aid formula would end the present separate grants for various diseases and would substitute lump sum grants to the states.

OTHER BILLS

Other bills in the Congressional hopper provide for increased medical care for the indigent and other public assistance beneficiaries, such as blind persons, through creation of a federal fund to match state and local health care expenditures, grants for medical care of mothers and crippled children, funds for construction of new medical schools and for construction and equipment of laboratories in professional schools, hospitals and other nonprofit institutions. Schools of dentistry are specifically mentioned in bills providing funds for laboratory and school expansion.

David W. Brock, chairman of the Association Council on Dental Health; C. Willard Camalier, assistant secretary, and Rudolph H. Friedrich, secretary of the Council on Dental Health, met with Department of Health, Education and Welfare officials late in January to discuss proposed dental health legislation. Special emphasis was placed on care for the indigent.

Other proposed legislation of interest to dentistry is the Keogh-Jenkins bill, permitting professional men to set up retirement plans through tax-deferment of a portion of each year's income.

President Eisenhower in his health message called for an increased U. S. contribution to the World Health Organization, although as THE JOURNAL went to press legislation to effect the increase had not been introduced.

DENTAL MANPOWER NEEDS DISCUSSED IN RUSK REPORT

A slight reduction in the ratio of dental officers to members of the Armed Forces could make unnecessary any continuation of the special physician-dentist draft law to cover dentists. This possibility was indicated in a report issued in February by the Health Resources Advisory Committee of the Office of Defense Mobilization (the Rusk Committee). The report concluded, however, that the present number of dental school graduates was not adequate to meet current needs of the Armed Forces.

This conclusion is at variance with the results of a more recent survey of junior and senior dental students sponsored by the Department of Defense and the Health Resources Advisory Committee in cooperation with the American Dental Association's Council on Dental Education. The survey indicated that substantially all, if not all, of the military needs of the Armed Forces for the fiscal year 1956, beginning next July, could be met by members of the 1955 graduating class. The dentist-physician draft law is scheduled to expire June 30, although President Eisenhower and the Department of Defense have called for its extension.

Information received by the Association from Washington indicates that the Navy and Air Force have received enough applications from the senior classes to fill their needs for the fiscal year beginning next July and that the Army is now in the process of filling its needs. Association officials have pointed out that the ratio of physicians to members of the Armed Forces has been reduced but that the ratio of dental officers has remained approximately the same.

COURT RULES AGAINST ADVERTISING LABORATORY

Commercial dental laboratories which by advertisements or other means imply that they can perform the entire operation in furnishing dentures or other appliances are violating the law, Judge John E. Mullen of the Superior Court in Providence, R. I., held February 7. The Judge found that Irving Dental Lab., Inc., of Woonsocket, R. I., by newspaper advertisements and the setup of its quarters,

advertised and practiced dentistry illegally.

He granted the Rhode Island State Board of Examiners in Dentistry a permanent injunction preventing the laboratory from practicing dentistry, from using the word "dentist" in connection with its name and from advertising in the manner in which it had done in the local press.

The court ruled that under the state dental practice law it is the practice of dentistry to provide dentures and thus is illegal for anyone but dentists to make and supply dentures. Technicians may do such work only on written prescription and from impressions made by dentists. The laboratory must make clear in its advertisements that its work is done in this fashion.

Association Affairs

REDUCE NUMBER OF SPECIALTY BOARDS, CONFEREES SUGGEST

Dentistry must not oversegment itself by the formal recognition of many specialty groups and the creation of numerous specialty boards. This was the opinion of participants in the Second Workshop on Dental Specialties held in Chicago February 7 and 8 under the auspices of the Council on Dental Education. The conferees agreed that a new structure of specialty boards should be developed to make possible the reduction of the total number of boards.

PLAN MORE SYMPOSIA FOR ANNUAL SESSION

Plans are under way to increase the number of panel discussions on the scientific program at the Association's 96th annual session in San Francisco October 17-20, the Council on Scientific Session has announced. At its January meeting held in the Central Office, the Council met with section officers to begin work on the October session.

Five half days will be allotted for the essay program, the Council decided, and four half days for projected clinics. Table clinics will be presented every morning instead of on three half days in order to reduce the number being presented at any one time. In this way better access to the clinics will be possible and the dentist will be able to see more of the total number presented.

The film program will continue throughout the entire scientific session. Individuals or organizations who have recently produced films relating to dentistry which might be suitable for showing at the annual session are requested to write to the Association Film Library for film preview applications. Their films can then be considered for showing at the annual session.

The general meeting has been set for Tuesday evening, October 18. The Housing Bureau opens April 1. An application blank for housing will appear in THE JOURNAL beginning in April.

ACT TO PROTECT PATIENTS FROM HEART INFECTION

In a concerted effort to focus the attention of the dental profession on the importance of preventive measures against bacterial endocarditis, an often fatal inflammation of the heart lining, the American Dental Association and the American Heart Association have joined forces. The two organizations have agreed on recommended dosages and procedures for administering penicillin

to patients with a history of rheumatic fever or with a valvular heart defect prior to any dental treatment that results in a break in the surface of the gingiva.

A chart showing recommended dosages is being distributed by the American Dental Association to its entire membership. These recommendations are being published also in THE JOURNAL and in the JOURNAL OF ORAL SURGERY. Copies of the chart entitled "How the Dentist Can Protect His Patients from Bacterial Endocarditis" may be obtained from the American Heart Association, 44 E. 23 St., New York 10.

DENTAL CARE FOR INDIGENT SUBJECT OF COUNCIL SURVEY

A survey of state programs of dental care for the indigent is being conducted by the Council on Dental Health, according to David W. Brock, chairman. Pointing out that President Eisenhower has recommended to Congress federal support of state and local health care programs for the indigent, Dr. Brock emphasized the importance of obtaining information on dental care programs currently in operation.

"The Association wants to make recommendations to federal agencies and to Congress which will meet the needs of the public," Dr. Brock said. "To do this, we must have additional information."

The Council's questionnaire is being mailed to constituent society secretaries who will obtain the needed information from state welfare departments. A questionnaire similar to that being sent the state societies has been mailed to component societies in the 18 largest U. S. cities as many dental care programs are wholly supported at the local level.

Data requested relate to identification of the agencies providing care, means used in determining eligibility for such care, types of services provided and methods of determining fee schedules.

COLORADO ACCEPTS NATIONAL BOARD, COUNCIL REPORTS

Another state has accepted the certificates and grades of the National Board of Dental Examiners as partial fulfillment of licensing requirements, announced Victor L. Steffel, chairman of the Council of the National Board of Dental Examiners at the Council's meeting in Chicago February 7 and 8. The dental examiners of the State of Colorado voted in January to accept the certificate and grades of the National Board in lieu of the state's written examination, Dr. Steffel reported. There are now 28 states recognizing the National Board.

U. S. VISITORS TO FRANCE CALL HAROLD HILLENBRAND

Americans planning to attend the Semaine Odontologique, scientific meeting of the French dental groups, scheduled for March 31 to April 6 in Paris are asked to call or wire Harold Hillenbrand, Association secretary, at the Central Office, 222 E. Superior St., Chicago 11.

COUNCIL APPROVES NINE HOSPITAL PROGRAMS

Internship and residency programs of nine hospitals were approved by the Council on Dental Education at its meeting February 3 and 4 in the Central Office. In addition to the approval of these programs, the Council adopted a policy which permits accreditation of hospital programs as either "approved" or "provisionally approved." Previously, the only accreditation classification for internships and residencies was "approved."

The internship and residency programs which were accredited at the meeting are:

Delaware Hospital, Wilmington, Del., residency in oral surgery; Veterans Administra-

tion Hospital, Hines, Ill., rotating dental internship; Indiana University Medical Center Hospital, Indianapolis, internship in oral surgery, residency in oral surgery; U.S. Naval Dental School, National Naval Medical Center, Bethesda, Md., residency in oral surgery, residency in periodontics; Albert Einstein Medical Center, Southern Division, Philadelphia, rotating dental internship; Brooke Army Hospital, Brooke Army Medical Center, Fort Sam Houston, Texas, residency in oral surgery, residency in prosthodontics; City County Hospital, Dallas, Texas, residency in oral surgery; Veterans Administration Hospital, Houston, Texas, residency in oral surgery, and William Beaumont General Hospital, Fort Bliss, Texas, rotating dental internship.

With the accreditation of these programs, internships and residencies have now been approved in 148 hospitals.

R. H. FRIEDRICH ELECTED TO NATIONAL HEALTH COUNCIL

R. H. Friedrich, newly appointed secretary of the Council on Dental Health, has been elected to the Board of Directors of the National Health Council, succeeding Harold Hillenbrand, Association secretary. The National Health Council is composed of some 60 national organizations in the health field. Its activities, which include a yearly national health forum, are designed to promote the good health of the nation through fostering joint planning and coordination of efforts of state, local and national health groups.

RELIEF FUND DRIVE NEARS $100,000 GOAL

Eleven additional state societies exceeded their quotas in the Relief Fund drive as contributions reached $94,431 on February 11. Only $5,569 is needed to reach the $100,000 goal. Over the 100 per cent mark for the first time this year were Arkansas, Delaware, Georgia, Kentucky, Maryland, New Mexico, North Carolina, Oklahoma, Oregon, Rhode Island and Utah.

In all, 24 states and the U.S. Public Health Service have topped their quotas. With 95.2 per cent of quota contributed, the smaller societies continued their lead over the larger ones. In addition to those societies which have already reached their quotas, 16 constituents have passed the 90 per cent mark of which eight are over 98 per cent. Only 16 societies have contributed less than 90 per cent of quota.

Students contributed $625, and $240 has been given as memorials. Contributions as of February 11 were:

Quota over $925

	Quota	Contributions to February 11	Pct.
California	$ 3,820.00	$ 3,746.50	98.1
So. California	4,580.00	7,355.50	160.6
Colorado	960.00	946.00	98.5
Connecticut	1,940.00	1,762.50	90.9
Florida	1,380.00	1,334.00	96.7
Georgia	1,020.00	1,486.00	145.7
Illinois	7,240.00	7,090.06	97.9
Indiana	2,340.00	2,322.00	99.2
Iowa	1,780.00	2,023.00	113.7
Kansas	960.00	868.65	90.5
Kentucky	1,130.00	1,338.30	118.4
Louisiana	1,020.00	956.50	93.8
Maryland	1,060.00	1,091.00	102.9
Massachusetts	3,690.00	1,734.50	47.0
Michigan	4,100.00	4,052.15	98.8
Minnesota	2,840.00	2,811.05	99.0
Missouri	2,450.00	2,436.50	99.4
Nebraska	1,060.00	1,148.00	108.3
New Jersey	4,020.00	3,963.50	98.6
New York	15,200.00	9,915.50	65.2
N. Carolina	1,240.00	1,264.00	101.9
Ohio	4,920.00	4,168.75	84.7
Oregon	1,230.00	1,242.00	101.0
Pennsylvania	6,810.00	4,999.75	73.4
Tennessee	1,310.00	3,583.00	273.5
Texas	3,190.00	2,382.50	74.7
Virginia	1,150.00	1,108.50	96.4
Washington	1,800.00	2,108.00	117.1
Wisconsin	2,930.00	2,114.50	72.2
Total	$87,170.00	$81,352.21	93.3

Quota of $925 or less

	Quota	Contributions to February 11	Pct.
Air Force	$ 600.00	$ 366.25	61.0
Alabama	800.00	1,466.50	183.3

Alaska	60.00	163.00	271.7
Arizona	300.00	104.00	34.7
Arkansas	560.00	578.50	103.3
Army	580.00	523.50	90.3
Delaware	150.00	158.00	105.3
Dist. of Col. ...	830.00	813.50	98.0
Hawaii	350.00	554.00	158.3
Idaho	260.00	301.50	116.0
Maine	460.00	308.00	67.0
Mississippi	530.00	475.00	89.6
Montana	370.00	518.00	140.0
Navy	920.00	457.50	49.7
Nevada	100.00	128.50	128.5
N. Hampshire ..	300.00	216.00	72.0
New Mexico ...	240.00	246.50	102.7
North Dakota ..	330.00	528.55	160.2
Oklahoma	920.00	965.00	104.9
P. Canal Zone..	10.00	10.00	100.0
P. Health Serv..	210.00	270.50	128.8
Puerto Rico ...	190.00	135.50	71.3
Rhode Island ..	560.00	655.00	117.0
So. Carolina ...	450.00	314.50	69.9
So. Dakota	350.00	141.00	40.3
Utah	470.00	513.50	109.3
Vermont	200.00	142.00	71.0
Vet. Admin. ...	810.00	315.00	38.9
West Virginia ..	760.00	703.50	92.6
Wyoming	160.00	140.50	87.8
Total $12,830.00		$12,212.80	95.2

BENEFITS OF ACCREDITATION, SPECIALTY BOARDS DISCUSSED

The school accreditation program of the American Dental Association has benefited the public, the dental schools, the profession and students, participants in the Eleventh Congress on Dental Education and Licensure declared February 5. Approximately 130 persons attended the Congress in the Conrad Hilton Hotel, Chicago, conducted under the auspices of the Council on Dental Education. Philip E. Blackerby, Jr., Council chairman, presided at the Conference.

Moderator at the morning session was William N. Hodgkin of Warrenton, Va. Panel participants were Robert W. McNulty, dean of the University of Southern California; Arthur W. Easton of Norway, Me. (whose paper, in his absence, was read by Frank O. Alford of Charlotte, N. C.); Gerald D. Timmons of Philadelphia; Harold W. Oppice of Chicago, and Shailer Peterson, Council secretary.

Dental specialty boards and specialty legislation were discussed at the afternoon session which was moderated by Russell A. Dixon, dean of Howard University College of Dentistry. Panelists included Joseph L. Bernier of Washington, D. C.; George W. Teuscher of Chicago; James R. Hayward of Ann Arbor, Mich.; Herbert L. Bunker of Junction City, Kan., and Wendell L. Wylie of San Francisco.

COUNCIL ON THERAPEUTICS APPROVES FLUORIDE REPORT

A report on the prescription of fluorides for individual use was approved by the Council on Dental Therapeutics at its meeting January 21 and 22 in the Central Office. The report, which will be published in THE JOURNAL, points out that oral administration of fluorides on a prescription basis may be effective theoretically, but it emphasizes the practical difficulties and limitations of the procedure.

Floyd D. Ostrander of Ann Arbor, Mich., who left the Council in 1954 after 12 years of membership, was honored at the meeting for his "long and valuable service" and his "leadership and inspiration to the Council."

Dental Societies

DANIEL LYNCH HONORED AT TESTIMONIAL DINNER

More than 500 persons honored Daniel F. Lynch, president of the American Dental Association, at a testimonial dinner February 14 in Washington, D.C. The event was sponsored by the District of Columbia Dental Society. A scroll and a gift of luggage were presented to Dr.

Shown at the testimonial dinner given by the Washington, D. C., District Dental Society for Association president Daniel F. Lynch February 14 are (l. to r.): Harold Hillenbrand, Association secretary; Karl H. Wood, president of the District society; Dr. Lynch, and David J. Fitzgibbon, chairman of the testimonial dinner.

Lynch on behalf of the Society by Karl H. Wood, its president.

In addition to a number of Association officials, the assemblage included presidents of state dental societies in the District of Columbia area and officers of the bar association, medical societies, service and civic clubs. Robert W. Bolwell, dean of the graduate school of George Washington University, and Harold Hillenbrand, secretary of the American Dental Association, were principal speakers.

Among those paying tribute to Dr. Lynch were the three vice-presidents of the Association, Curtis A. Haggard, Frederick W. Herbine and John E. Fauber, and five Association trustees, Edward R. White, Percy T. Phillips, Howard B. Higgins, Charles H. Patton and Charles I. Taggart.

Also at the testimonial were Walter Martin, M.D., president of the American Medical Association; Mr. Renah Camalier, District of Columbia commissioner, and Walter T. McFall, representing the Psi Omega fraternity. David J. Fitzgibbon of Washington, D.C., was toastmaster and chairman, and James P. Kerrigan, also of Washington, was co-chairman.

The invocation was pronounced by the Very Rev. B. Bunn, S.J., president of Georgetown University. Others at the dinner were Charles B. Murray, president of the District of Columbia Bar Association; Granville Gude, president of the Rotary Club of Washington, D.C., and P. A. McLendon, M.D., president of the District of Columbia Medical Society.

RHODE ISLAND SOCIETY CITES HAROLD PEARCE

A gold medal and scroll, given for meritorious service to dentistry, was awarded Harold J. Pearce by the Rhode Island State Dental Society in January. Dr. Pearce was one of the founders and was the first president of the Providence (R.I.) District Dental Society. He has served as a trustee from the Providence district to the Rhode Island State Dental Society since 1947. For many years he has been a member of the state society's judicial council.

A gold medal and scroll was awarded Harold J. Pearce by the Rhode Island State Dental Society at its meeting in January. Shown at the presentation are (l. to r.): Morris L. Biderman, society president; Dr. Pearce, and Michael B. Messore, chairman of the award committee.

RESEARCH TEAM WINS CHICAGO DENTAL SOCIETY ESSAY PRIZE

More than 13,000 dentists from the United States and abroad attended the 90th Midwinter Meeting of the Chicago Dental Society held in the Conrad Hilton Hotel, Chicago, February 6-9. The $500 annual prize essay contest of the society was won by a research team of eight scientists representing the University of Chicago and the University of Notre Dame, aided by the Office of Naval Research. The essay described experimental work with animals demonstrating that certain bacteria cause dental decay.

A plaque emblematic of the 14th annual award was presented at the first general session of the Midwinter Meeting. It was accepted by Frank J. Orland, director of the Zoller Memorial Dental Clinic, University of Chicago, representing the research team. The presentation was made by Samuel R. Kleiman, president of the Society.

In addition to Dr. Orland, the research group includes J. Roy Blayney, retired director of the Zoller Memorial Dental Clinic, University of Chicago; Prof. R. Wendell Harrison, University of Chicago bacteriologist who is now University vice-president; Professors James A. Reyniers, Philip C. Trexler, Robert F. Ervin, Helmut A. Gordon and Morris Wagner, all of the Lobund Institute for Research in the Life Sciences, University of Notre Dame. The Office of Naval Research helped finance the research project.

Dentists attending the meeting heard Chicago described as the world's headquarters for illegal dental laboratories. Edgar T. Stephens, program director of the Chicago Dental Society, said "it reliably has been estimated that in addition to the health hazards involved the public is being defrauded of approximately $9,000,000 annually through its purchases of illegally constructed dentures."

FERNANDO ORDONEZ HEADS PUERTO RICAN SOCIETY

Fernando Ordonez was installed as president of the Colégio de Cirujanos Dentistas de Puerto Rico at a meeting January 30 in San Juan. Others installed were Guillermo T. Calderon, vice-presi-

During a recent meeting of the Colégio de Cirujanos Dentistas de Puerto Rico, a number of guests were made honorary citizens of the city of San Juan. Shown (l. to r.) are: Harold Hillenbrand, secretary of the American Dental Association; Lee Roy Main, dean of the School of Dentistry, St. Louis University; Daniel F. Lynch, Association president; Shailer Peterson, secretary of the Association's Council on Dental Education; Felisa Rincon de Gautier, mayor of San Juan; Maj. Gen. Oscar P. Snyder (DC) USA; Rear Admiral Daniel W. Ryan (DC) USN, and Jose M. Gonzales, outgoing president of the Colégio.

dent; Manuel A. Rosso, secretary; Benjamin Vargas, treasurer; Mr. Constantino Fernandez, executive secretary, and Jose L. Goenaga, auditor.

In conjunction with the meeting, a number of guests were made honorary citizens of the city of San Juan by Felisa Rincon de Gautier, mayor of San Juan. The men so honored included Harold Hillenbrand, secretary of the American Dental Association; Lee Roy Main, dean of the School of Dentistry, St. Louis University; Daniel F. Lynch, Association president; Shailer Peterson, secretary of the Association's Council on Dental Education, Maj. Gen. Oscar P. Snyder (DC) USA, and Rear Admiral Daniel W. Ryan (DC) USN. In addition, Dr. Lynch was made an honorary citizen of Puerto Rico.

Dental Education

TUFTS COLLEGE CALLS SIXTH BERKSHIRE CONFERENCE

Four days of lectures, seminars and panel discussions on problems of periodontology and oral pathology are planned for the Sixth Annual Berkshire Conference scheduled June 19-23 in Lenox, Mass. A special feature of the Conference will be a clinicopathological seminar with microscopes provided for all participants.

Among the faculty will be C. D. Marshall-Day and Irving Glickman of Tufts College Dental School; Reidar F. Sognnaes of Harvard School of Dental Medicine; Harry Sicher of Loyola University School of Dentistry; Joseph Bernier, of the Armed Forces Institute of Pathology; Paul E. Boyle, University of Pennsylvania School of Dentistry; Benjamin E. Etsten, M.D., Tufts Medical School, Edward H. Kass, M.D., Harvard Medical School, Stanley Tylman, University of Illinois School of Dentistry, Oliver C. Applegate, University of Michigan, and George Stewart of Philadelphia.

Further information on the Conference may be obtained from the Sixth Annual Berkshire Conference, Tufts College Dental School, 136 Harrison Ave., Boston 13.

DISCUSS PLANS FOR PUERTO RICAN DENTAL SCHOOL

A dental school for Puerto Rico was discussed late in January by representatives of the University of Puerto Rico, the Puerto Rican dental society and representatives of the American Dental Association. Chancellor Jaime Benitez of the University told dental representatives that he believed a dental school was needed but that it would be three years or so before the program could be established. It is expected that the new school would have about 40 students in its freshman class.

A survey of the dental needs of the island was made recently by the Colégio de Cirujanos Dentistas de Puerto Rico, the Puerto Rican dental society. Of the dentists answering the questionnaire, 95 per cent said that Puerto Rico needed a dental school, and 90 per cent indicated that they would be interested in attending graduate or postgraduate courses which could be offered by the new dental school.

Harold Hillenbrand, Association secretary, and Shailer Peterson, secretary of the Association's Council on Dental Education, met with University officials at the invitation of Chancellor Benitez.

SETON HALL AND WASHINGTON NAME DENTAL SCHOOL DEANS

Merritte M. Maxwell has been named dean of the newly founded Seton Hall College of Dentistry in Jersey City. Dr. Maxwell, who has been a captain in the U.S. Navy, is a specialist in oral surgery. He is a fellow of the American College of Dentists and the International College of Dentists. He was graduated from the

College of Dentistry of the University of California in 1925.

On January 15, the Board of Regents of the School of Dentistry of the University of Washington (Seattle) selected Berton E. Anderson as acting dean. Dr. Anderson will serve until a permanent successor is named for former dean Ernest M. Jones who resigned in December. Dr. Anderson, a faculty member since 1948, has been assistant dean since last October.

TEACHERS ASKED FOR EGYPT DENTAL SCHOOL

Teachers are needed for the Cairo dental school, according to LeRoy M. Ennis, former president of the American Dental Association who is now serving as dental consultant to the Egyptian government. Persons interested in teaching positions may write to Dr. Ennis at 6 Salsul St., Garden City, Cairo, Egypt.

USPHS STUDY RECOMMENDS DENTAL SCHOOL FOR OKLAHOMA

The average number of persons per dentist in the United States is 1,677; in Oklahoma it is 2,727. The median age of employed male dentists in the United States is 46.6 years; in Oklahoma it is 49 years. Population growth, anticipated shifts toward urbanization and an increase in the appreciation of the importance of dental care are among the reasons that a study by the U. S. Public Health Service recommends establishment of a dental school for the state of Oklahoma.

The study, entitled *Oklahoma's Dental Manpower Requirements,* recommends that a dental school be established with facilities for at least 200 undergraduate dental students. Also recommended is the establishment of a dental hygiene school with a minimum enrollment of 40 students.

TO GRANT FELLOWSHIPS IN CHILDREN'S DENTISTRY

Two C. S. Mott Foundation fellowships for graduate study in dentistry for children are available to licensed dentists who can meet the entrance requirements of the School of Graduate Studies of the University of Michigan. The two candidates are to be selected early in May.

Each fellowship provides for 17 months of formal graduate study at the W. K. Kellogg Foundation Institute of Graduate and Postgraduate Dentistry at the University of Michigan. Tuition for three regular semesters and a summer school session is paid as well as a living stipend of $150 a month. After the completion of formal study, the fellow spends one year at the Children's Clinic of the Mott Foundation's Children's Health Center, Hurley Hospital, in Flint. The stipend is $4,400.

Application may be made to Kenneth A. Easlick, professor of dentistry, School of Dentistry, University of Michigan, Ann Arbor, Mich.

CREIGHTON TO CELEBRATE FIFTIETH ANNIVERSARY

A Golden Jubilee Celebration, honoring Edward Creighton, founder of the Creighton University School of Dentistry in Omaha, will take place as the School marks its fiftieth anniversary April 20 to 22. Daniel F. Lynch, president of the American Dental Association, will be a guest speaker at the Jubilee Dinner.

LAUNCH PARTICIPATING FUND FOR DENTAL EDUCATION

The University of Buffalo School of Dentistry on February 1 initiated a campaign to raise an annual participating fund for dental education, designed to bring $50,000 during the first year. The fund will be used to enlarge the full-time

teaching staff of the dental school, to increase the number of students admitted each year, to expand research and to widen postgraduate programs for dentists.

Edward F. Mimmack, chairman of the executive committee of the fund, said that although the school had excellent teaching and clinical facilities in its new building, the fund was needed to improve the education program. An annual pledge of at least $100 will be sought from each dental alumnus of the university and from other members of the dental profession in western New York.

TO SURVEY DENTAL NEEDS OF WESTERN STATES

The Western Interstate Commission on Higher Education during the next year will conduct a study in cooperation with the U. S. Public Health Service on dental needs of the Western states. The study will consider also the needs for a dental school in the Mountain State area. Philip E. Blackerby, Jr., and Shailer Peterson, chairman and secretary respectively of the American Dental Association Council on Dental Education, have been invited to attend a March meeting of the Commission to discuss the proposed survey.

An additional project of the Commission is the establishment of regional education programs whereby states not having professional schools will help support schools which accept out-of-state residents.

FATHER O'LEARY, LOYOLA DENTAL SCHOOL REGENT, DIES

The Reverend William D. O'Leary, S.J., regent of the Loyola University School of Dentistry in New Orleans, died February 1 after a heart attack. He was 58 years old.

Rev. W. D. O'Leary

Father O'Leary received his M.D. degree from the University of Georgia in 1921 and practiced medicine in Boston and New York until 1925 at which time he entered the Society of Jesus (the Jesuit Order) and began his studies for the priesthood. He was ordained in 1934.

Prior to appointment as regent, Father O'Leary served as acting dean of Loyola's dental school. He was a member of Kappa Delta Pi, an honor society in education, and of Alpha Omega Alpha, honor medical society.

SCHOOLS ANNOUNCE LECTURES, GRADUATE PROGRAMS

Beth Israel • The teaching division of the dental department at Beth Israel Hospital in Boston announces a two week conference and seminar in periodontology May 9-20. The conference, under the direction of Henry M. Goldman and Bernard Chaikin, will cover both the theory and technics of periodontal therapy. Further information may be obtained from the coordinator of education programs at the Hospital.

California • The University of California Extension in Los Angeles presents two general refresher courses of nine weeks' duration, one beginning April 18 and one November 28. Half the course time will be devoted to lectures, the rest to laboratory technics and clinical pro-

cedures. Further information may be obtained from J. Eugene Ziegler, head of the dental program, University of California Extension, 815 S. Hill St., Los Angeles 14.

Columbia • The second Rose Cohen Memorial Lecture, sponsored by the division of periodontology of Columbia University Dental School, will be held March 30 at the School in New York. Lent C. Johnson of the Armed Forces Institute of Pathology will lecture on bone resorption and reconstruction. Felix Bronner of the Rockefeller Institute for Medical Research is discusser.

Indiana • Three symposia to take place in April have been planned by the Indiana University School of Dentistry in Indianapolis. Crown and bridge construction will be presented April 6; cancer in children, April 20, and endodontics, April 21. In addition, the School offers a course on oral surgery April 4-8. Application blanks may be obtained from the office of the dean.

Southern California • A comprehensive review of dentistry designed to be of especial value to candidates for the California licensure examinations is offered by the University of Southern California School of Dentistry in Los Angeles May 2 to June 17. The course covers a review of the undergraduate curriculum, including laboratory technics and operative dentistry procedures at the chair.

Tufts • Tufts College Dental School announces a comprehensive two year training program in periodontology leading to a Master's degree. The course, which is under the direction of Irving Glickman, consists of three main divisions: instruction in basic science, oral and clinical medicine; clinical training in periodontology, and research.

Washington (Seattle) • A dental refresher course in silver amalgam restorations is scheduled April 4-6 at the University of Washington School of Dentistry in Seattle. Miles R. Markley will teach. Instruction will be by lecture, demonstration and laboratory practice.

Western Reserve • Two refresher courses, one in crown and bridge technic, the other in endodontics, are scheduled for the summer months at Western Reserve University in Cleveland. Crown and bridge dentistry will be taught June 27 through July 1 under the direction of R. P. Dressel, with Morris J. Thompson of Beverly Hills, Calif., as guest lecturer and clinician. Endodontics is offered June 6-8, directed by Paul Sherwood, with Ralph Sommer of the University of Michigan as guest lecturer and clinician.

Research

NEW FILM ANNOUNCED BY BUREAU OF STANDARDS

The ability of different types of dental burs to cut hard and soft tooth structures is explained in a new film produced by the National Bureau of Standards in cooperation with the U. S. Air Force Dental Service. The film, *Dental Burs in Action,* is designed for showing to professional groups and may be obtained from the National Bureau of Standards in Washington, D. C.

LATEST RESEARCH TO BE REPORTED AT I.A.D.R. MEETING

A new theory of periodontal disease, results of additional research on fluoride-containing dentifrices and a study on the biologic effect of an ultrasonic dental cutting device are among the topics of papers to be presented at the March 18-20 meeting of the International Association for Dental Research. More than

200 ten minute reports on new discoveries in all fields of dental research will be given by the nation's top researchers. The meeting will be held at the Morrison Hotel, Chicago.

A number of reports deal with the effectiveness of newer plastic filling materials. To be discussed also is a method for comparing the wear resistance of materials used for artificial teeth. Toxicity studies of local anesthetics will be presented.

For the first time, printed abstracts of all reports will be available in advance of the meeting. The price of the abstracts is included in the registration fee of two dollars.

In addition to the research papers, the I.A.D.R. program will include an address by Harold C. Urey, noted physicist and the presentation of both the Novice Award and the Souder Award. Those eligible for the Novice Award must be researchers who are presenting a research paper for the first time. The Souder Award is given for research in dental materials.

International

NEW OFFICERS NAMED FOR ARGENTINE ASSOCIATIONS

The 1955 officers for the Asociación Odontológica Argentina are: Hernán M. Echneique, vice-president; José L. Ferreria, assistant secretary; Gregorio Chudnovsky, assistant treasurer; Hector Tarasido, Adolfo Niebuhr and Eduardo Silvestre, voting members; Norberto Costóyas, Manuel Muñiz, and Mario W. Goderch, alternates.

The Círculo Odontológico de Córdoba also elected officers recently. Chosen to head the organization were: Victor Adanda, president; Moisés Lerman, secretary, Ismael Mendiondo, assistant secretary, Jesús Osorio Sánchez, cultural secretary; Salomon Levin, treasurer; Osvaldo López and Manuel Rodriguez, voting members; Ricardo Cuestas Carnere and Corominas Villafñe, alternates.

A new organization, the German Argentine Association for the Exchange of Scientific and Technical Information, was founded June 9 with headquarters at Cerrito 743, Buenos Aires. Under the direction of Carlos F. Hickethier it has now drawn up its constitution.

AMERICAS GET FULL-TIME DENTAL CONSULTANT

Dental problems received increased attention from the World Health Organization as the international group appointed its first full-time dental consultant recently. He is Mario Chavez of Rio de Janeiro, Brazil, who will become consultant to the Central and Latin-American countries in June. Dr. Chavez holds M.D. and D.D.S. degrees and is presently studying at the University of Michigan School of Public Health.

Information available from Association publications is discussed by B. Duane Moen (left), director of the Bureau of Economic Research and Statistics; R. H. Friedrich, secretary of the Council on Dental Health, and Mario Chavez, future World Health Organization dental consultant for Central and Latin-America. Dr. Chavez visited the Central Office recently.

PRELIMINARY PROGRAM READY FOR F.D.I. MEETING

The preliminary program for the 43rd annual meeting of the Fédération Dentaire Internationale to be held August 14-20 in Copenhagen, Denmark, is now available. Copies may be obtained from W. Riis Klausen, honorary secretary of the organizing committee, 1, Alhambravej, Copenhagen 5, Denmark. Registration for the meeting will be at regular rates before May 1; an additional fee will be charged for applications received after that date, Dr. Klausen has announced.

TOUR PLANNED AT TIME OF F.D.I. AUGUST MEETING

A six week tour of the Scandinavian countries and England, planned to coincide with the August meeting of the Fédération Dentaire Internationale in Copenhagen, Denmark, has been announced by the Carrick Travel Bureau. Sailing from New York August 3, the tour group arrives in Copenhagen August 12. After the F.D.I. meeting, which ends August 20, the group will travel through the lake district of Sweden to Stockholm then to Oslo and the fjord country of Norway. Edinburgh, Windermere, Stratford-on-Avon will be visited also. Three days will be spent in London before the return trip September 9.

Further information may be obtained from Carrick Travel Bureau, Oberlin Bank Bldg., Oberlin, Ohio.

HOLLAND TO BE HOST TO AMERICAN DENTAL SOCIETY

Amsterdam, Holland, will play host to the July 11-14 meeting of the American Dental Society of Europe, James P. Molony, Society secretary has announced. The Society is composed of members of the profession who have degrees from American dental schools and who are practicing abroad. Information on the meeting may be obtained from Dr. Molony, 110 Harley St., London W. 1.

National Defense

ADMIRAL BOONE, VA MEDICAL DIRECTOR, RETIRES

The retirement of Vice Admiral Joel T. Boone (MC) USN, Rtd., as chief medical director of the Veterans Administration was announced February 2 by Harvey V. Higley, administrator of Veterans Affairs. William S. Middleton, dean of the University of Wisconsin Medical School, succeeds Admiral Boone on March 1.

Admiral Boone retires after nearly 41 years in public service. He has received many decorations from both the United States and other governments. He served as White House physician for Presidents Harding, Coolidge and Hoover.

ADMIRAL MALONE TO HEAD NAVY DENTAL CORPS

Rear Admiral R. W. Malone, presently inspector general, dental, will become assistant chief for dentistry and chief of the Navy dental division early in March, replacing Rear Admiral Daniel W. Ryan, the Secretary of the Navy announced recently. Admiral Malone, a graduate of Atlanta-Southern Dental College, was in private practice until entering the Navy in 1926. For many years he served as President Franklin D. Roosevelt's personal dentist.

Rear Admiral Ryan whom he replaces becomes inspector of naval dental activities, Pacific Coast, in April. The Secretary of the Navy also announced that Rear Admiral H. P. Riebe will become inspector general, dental, at the Bureau of Medicine and Surgery in May.

Public Health

DEATH FROM HEART DISEASE NOT DUE TO FLUORIDATION

Opponents of fluoridation have been erroneously quoting data published by the U. S. Public Health Service to show that the death rate for heart diseases is greater in Newburgh, N. Y., where a controlled fluoridation program is in progress, than in most other sections of the United States.

John W. Knutson, assistant surgeon general and dental chief of the USPHS, has called attention to the fact that wrong conclusions are being drawn from the data. Increases in crude death rates over the past decade are not restricted to Newburgh, he pointed out. These increases reflect mainly the increased longevity of the population and not the increased consumption of fluoridated water. Dr. Knutson also pointed out that comparable death rates for the nonfluoride control city of Kingston, N. Y., exceeded those for the nation as a whole in both 1950 and 1940.

Dr. Knutson's statement has been excerpted by the American Dental Association's Council on Dental Health, and copies are available from the Council at the Central Office, together with a table published by the New York State Department of Health showing data on deaths due to cardiovascular-renal diseases among residents of Newburgh and Kingston for 1942-1953.

General

PLAN FLUORIDATION PANEL FOR NATIONAL HEALTH FORUM

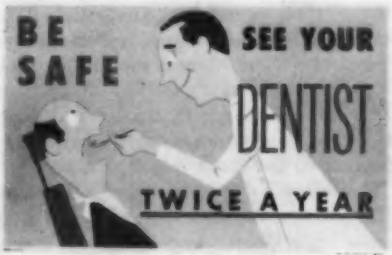
A panel discussion on the responsibility of the community regarding fluoridation of domestic water supplies will be presented as part of the National Health Forum March 23 and 24 at the Hotel Sheraton Astor in New York. The forum is sponsored by the National Health Council. J. Roy Doty, secretary of the American Dental Association Council on Dental Therapeutics; Mr. Herbert B. Bain, director of the Association's Bureau of Public Information, and Mr. Al Schottelkotte, science editor of the *Cincinnati Enquirer,* will be panelists.

BOARD OF ORAL SURGERY SETS EXAMINATION DATE

The American Board of Oral Surgery examination will be held April 2-4 at the Blackstone Hotel in Chicago. Information on the examination may be obtained from Leslie M. FitzGerald, secretary, 718 Roshek Bldg., Dubuque, Iowa.

DEATH OF SOCIETY SECRETARY, JAMES BURNS, REPORTED

James R. Burns of Trenton, N. J., secretary of the Mercer County Dental Society for the past five years, died January 7. Dr. Burns was a member of the American Dental Association House of Delegates and was a former trustee of the New Jersey State Dental Society.



During March members of the Linen Supply Association of America will carry on their more than 2,500 trucks four-color posters urging the public to "Be Safe . . . See Your Dentist Twice a Year."

Alexander Coulouriotes, a student at Tufts College Dental School, won a $300 prize in the American Denture Society's essay contest last year. Participating in the presentation of the award money to Dr. Coulouriotes (left) were Irving H. Hardy, of Tufts; John R. Wallace, past president of the American Denture Society, and C. David Marshall-Day, dean of Tufts College Dental School. Essays for the American Denture Society's current contest must be submitted by July 15.

EMMA T. READ, PIONEER WOMAN DENTIST, DIES AT 97

Emma T. Read, one of the first women dentists in California to receive a license to practice, died January 7 at the age of 97. She was perhaps the last of the exclusively apprentice-trained dentists left in California. Trained in part by her dentist husband, William Star Read, she began her practice in 1875 in Missouri and moved to San Diego in 1887 where she practiced for 49 years until illness forced her retirement in 1936.

Dr. Read helped to organize the first dental society in San Diego in the late eighties and helped to reorganize it when the National Dental Association was formed. Dr. Read was a member of the Southern California State Dental Association and was a member also of Upsilon Alpha, the national women dentists' sorority.

M. E. ZINSER, PAST PRESIDENT OF ILLINOIS SOCIETY, DIES

Melford E. Zinser, a former president of the Illinois State Dental Society and a veteran member of the American Dental Association House of Delegates, died January 25 at the age of 58. Dr. Zinser served as president of the Loyola Dental Alumni Association and was entertainment chairman for the 1948 American Dental Association annual session. He was a delegate to the 1947 International Dental Congress in London.

Also • How people feel about dental and medical services, health personnel and voluntary health insurance will be probed in a survey of the Health Information Foundation. The study is the first nationwide survey of its type. . . . Recent visitors to the dental research section of the National Bureau of Standards in Washington, D.C., include Andre L. Brunel and Marcel Parant of France and Kaji Okumura of Japan. . . . Studies on the potential carcinogenic effects of tobacco and betel nut chewing on the cheek pouch mucosa of the hamster are being carried out by Anand P. Chaudhry, a dentist from India. Dr. Chaudhry is working at the School of Dentistry, University of Minnesota, on a Damon Runyon Memorial Fund stipend. . . . The California State Dental Association will conduct a one day meeting of its house of delegates April 16. There will be no scientific meeting this year because the annual session of the American Dental Association will be held in San Francisco this fall. . . . The Middlesex County Dental Society (New Jersey) will dedicate its March meeting to the Dental Corps of the U.S. Navy.

International Correspondence

NEWS FROM GREAT BRITAIN

There are in Great Britain a number of smaller dental organizations about which I propose to write this year.

Firstly, there is the British Society of Periodontology, a flourishing and active specialist society, which is in its sixth year of existence. Although its associate membership is open to all members of the dental profession, its full membership is restricted to 40. The secretary, Mr. Bryan Wade, sends me the following notes. Appreciation of the significance of the investing and supporting tissues of the teeth is steadily increasing in Great Britain, and this interest has been particularly well illustrated by two events which have occurred during the past year.

In September a conference of those teaching periodontology in the schools of Great Britain and Eire was held in the Medical School of the University of Birmingham under the auspices of the Dental Education Advisory Council. The Council is a committee consisting of the deans of the different dental schools and consequently is a body which has considerable influence in teaching matters. This conference was discussed more fully in the January letter under the heading "The Teaching Schools."

The second event was one revealed in the attendance figures at the general meetings of the metropolitan branch of the British Dental Association which showed that out of a series of meetings devoted to almost all aspects of dentistry the best attended was one at which a paper on periodontology in general practice was read by Mr. A. Frank Stammers, at that time president of the British Society of Periodontology. This Society continues its active life and has, in fact, already sponsored three meetings of teachers of periodontology preceding this year's conference.

The 1954-55 session of the Society is now under way. The Presidential address read by Mr. E. E. Hopper of the Sutherland Dental School of the University of Durham was followed by a paper on radiology in periodontal practice, read by Mr. W. A. S. Alldritt, one of the younger members. Mr. Alldritt has recently been appointed to Queen's University, Belfast, as he performed original work at the Institute of Dental Surgery of the University of London. Mr. Alldritt discussed this work in his address. At the December meeting a paper entitled "Dental Health Education in the United States" was read by Mr. A. E. Parrott, Gibbs travelling scholar for 1954. Mr. Parrott was in the United States during this past summer, and his keen observations are most instructive. His paper will be published in the *Proceedings of the British Society of Periodontology.*

Further meetings will be devoted to a symposium on occlusal equilibration and to a discussion of psychosomatic medicine at which time a physician will address the Society. In addition, members of the Society will travel to Newcastle to hear a paper by Prof. R. Bradlaw, dean of the Sutherland Dental School, Newcastle-upon-Tyne.

ORAL SURGERY CLUB

Another dental organization of interest is the Oral Surgery Club. The Oral Surgery Club is not an association but a club limited to 40 members whose chief interests lie in the teaching and practice of oral surgery. The president is Prof. T. Talmage Read, dean of the University of Leeds Dental School and Hospital, Leeds, 1. Prof. F. C. Wilkinson, director of the Eastman Dental Institute, is president-elect. Mr. R. Sutton Taylor is honorary secretary. The club holds two meetings a year.

A recently formed society is the Dental Implant Society, whose first meeting was July 1, 1954. The objects of the Society are to further the knowledge of implant dentures, to assist members to learn the technic of implant denture operations, and to publish studies of value to the dental profession. A series of implants are being undertaken, and members have the opportunity of seeing operations and the various stages of the implant technic (both clinical and laboratory) as the work progresses. So far all implants, screws and superstructures have been cast in Virilium chrome-cobalt-molybdenum alloy, but it is the intention of the Society to run a parallel series in Tantalum on the lines of the work done by Professor Marziani of Rome. (See the *International Dental Journal,* Vol. 4, No. 4, June 1954, p. 459.)

SHORTAGE OF STUDENTS

In an address at the opening of the 67th session of the Dental Board of the United Kingdom last November, the chairman, Sir E. Wilfred Fish, referred once again to a subject which he said was of cardinal importance to the profession and to the nation—the shortage of suitable candidates for a course in dentistry. He suggested the possibility that the dental curriculum in Great Britain might become too long and too academic. The profession of dentistry today has become much more complex than it was a quarter of a century ago, and the dental schools have to train people for all kinds of careers in dentistry.

The schools have to prepare men to become teachers, research workers, consultants and administrators, as well as general practitioners. It is necessary, he said, to have a degree course based on a general education for prospective teachers, research workers and consultants, but the general practitioner might not need or be able to take so complete a course. The General Medical Council, with the help of some of the members of the Dental Board and some of the teachers in the Universities, has laid down a minimum curriculum of four years below which the standard may not fall, but most of the degree courses are well in advance of this minimum and take five years at least to accomplish.

Some evidence exists that there are not enough men and women able and willing to take such extended courses, and unless the schools are full of advanced students, it is important to both the profession and the public that the universities should not abolish the four year course. The four year course has been judged to be adequate for a certificate of fitness to practice and is appreciably in excess of the minimum course required for a degree in arts, science, law or engineering.

The Dental Board adopted the report of the special committee on recruitment set up by the Board. Among the committee recommendations were competitive scholarships, prizes in dental school, loans to dental students and, in exceptional circumstances, grants, as well as a publicity campaign at a cost of between £9,000 and £13,000 per year.

THE SERVICES

Air Vice-Marshal G. A. Ballantyne retired on December 4, after having held the appointment of director of dental services of the Royal Air Force since May 1943. Gordon Ballantyne will always be remembered for the skill and determination which he displayed in making the dental branch of the Royal Air Force the efficient organization that it is. His many friends all over the world will wish him happy years of retirement.

Congratulations to Air Vice-Marshal M. J. Piggott, F.D.S.R.C.S. (Eng.) Q.H.D.S., who has succeeded Air Vice-Marshal G. A. Ballantyne as director of dental services, Royal Air Force. Mike Piggott has had an extensive administrative experience both abroad and at home, and there is great confidence that the dental branch is in secure hands.

It has been announced that Colonel D. J. Muil will succeed Major-General J. Wren as director, Army dental services, March 5, 1955.

BRITISH DENTAL ASSOCIATION

Most branches have now elected their representatives for the new Board which came into office on January 1, 1955. There have been few changes in representation. Nowhere is there any sign of the widespread discontent which has been said to exist. In not one branch has there been any revolutionary change in representation. It must be assumed that the membership as a whole has shown its confidence in the wisdom and integrity of the old Board.

Gerald H. Leatherman,
D.M.D., F.D.S.R.C.S.

Book Reviews

PATHOLOGY FOR STUDENTS OF DENTISTRY

By George L. Montgomery, M.D., Ph.D. 305 pages with 133 illustrations and 10 color plates. Index. Price $7.50. Baltimore, Williams and Wilkins Co., 1953.

This book covers the course in general pathology for undergraduate dental students at the University of Glasgow. Even though the content is limited to the principles of general pathology, the book contains two chapters dealing solely with mouth changes. One of these chapters deals with inflammations of the mouth and jaws and one with neoplastic and cystic conditions of tooth rudiments.

A number of opportunities to use mouth alterations as examples of general conditions have been used to good advantage. For example, the complete replacement of a child's jaw after loss by necrosis is used to explain the process of regeneration.

The illustrations vary from good to bad. The paper, type, printing and binding are excellent. In spite of the book's size the coverage is surprisingly inclusive, and it is no less remarkable that there seems to be no omission of essential subjects. It is a well prepared, authoritative, concise volume.

Edward H. Hatton

THE BIOCHEMISTRY OF CLINICAL MEDICINE

By William S. Hoffman, Ph.D., M.D. 681 pages with illustrations. Index. Price $12. Chicago, The Year Book Publishers, 1954.

This new work discusses the qualitative and quantitative biochemically-determined alterations of the body constituents that occur in illness. It shows the clinician how to utilize these alterations in diagnosis, prognosis and treatment. The approach is didactic, intended to relate biochemistry to the everyday problems of medicine. Some of the clinical entities are based so completely on biochemical data that the author writes complete essays on diabetes mellitus, nephritis, hepatitis and gout.

The arrangement of the book is comparable to other biochemical texts which discuss each of the components of the organism individually before attempting any functional integration. The author stresses function rather than structure in evaluating the underlying basis of disease. He clarifies the newer biological methods for estimating endocrine activity and discusses the microbiologic assays for the analysis of minute quantities in body fluids.

The book contains a practical evaluation of the use of isotopes in the study of immediate metabolism. The material is presented simply so that the dentist or specialist may find the book useful. No part of the body can be considered an isolated entity, for changes in any portion of the body, whether in the mouth or the kidney, reflect or produce biochemical changes throughout the body. Since the mouth reveals so much of the functional condition of a patient, it is incumbent on the dentist to keep pace with the ever-changing scientific concepts of body functioning in disease. The book introduces the reader to the current trends in the scientific interpretation of health and disease.

I. Newton Kugelmass

STEDMAN'S MEDICAL DICTIONARY

Edited by Norman Burke Taylor, M.D. in collaboration with Lieut. Col. Allen Ellsworth Taylor, M.A. Eighteenth edition. 1,561 pages with 622 illustrations. Appendix. Price $11.50. Baltimore, Williams & Wilkins Co., 1953.

The eighteenth edition of this well-known medical dictionary has an enlarged format and an increase of 200 pages over the preceding edition. Much of the increase is accounted for by the addition of hundreds of new definitions relating to recent developments in the medical sciences. Some obsolete terms have been deleted, and many definitions have been revised or expanded. Meaning, pronunciation, and derivation are given for every word. Terms used in dentistry, chemistry, veterinary medicine and other health sciences are included.

Various added or improved features facilitate the use of this edition. Several hundred new text figures, most of them original drawings, illustrate definitions. Anatomical tables listing arteries, muscles and nerves appear in their alphabetical place through the dictionary. Entries for anatomical terms have been translated from the former Latin forms and are now presented in their English equivalents

in the tables. The history of medicine is not neglected. Brief biographical sketches of leading figures in medical history are provided.

One of the most interesting sections of the dictionary is a valuable article on medical etymology, which contains a detailed root-word list. Comments are included on the careless formation of hybrid words which combine elements from different languages. Those who are discriminating in language will enjoy the article; others need it.

Despite the interest of the editors in word formation, dental specialties appear to be listed entirely with the less exact suffix *ia*—orthodontia—rather than the more accurate and currently approved ending *ics*—orthodontics. Perhaps an authority on dental nomenclature should be considered for inclusion in the work on future editions.

On the whole this edition continues the scholarly character and high standard long associated with *Stedman's Medical Dictionary.*

Ida Marian Robinson

KIEFERORTHOPÄDISCHE KLINIK UND THERAPIE (THE ORTHODONTIC CLINIC AND TREATMENT)

By Erwin Reichenbach, Dr. Med. Dent. and Hans Brückl, Dr. Med. Dent. Second edition. 162 pages with 426 illustrations. Index. Price. 9.60 German Marks. Leipzig, Germany, Johann Ambrosius Barth, 1954.

The first edition was printed in 1952, and this latest edition contains no changes. This book is written to fit European conditions and is directed specifically to the school dentists and to the dentists in social dentistry. An effort is made to simplify orthodontic treatment, and the methods described employ removable appliances.

The author is familiar with Baume's conceptions of the development of the dentition. The book emphasizes the importance of the position of the head during sleep for the prevention and correction of mouth breathing and malocclusion which result from this habit. The possibility of differentiating between hereditary and environmental etiologic factors is small, in the author's opinion.

The author classifies the types of malocclusion in six groups and describes the etiology, genesis, symptomatology and treatment of each group. Removable expansion plates are used in the treatment of all patients. The advantages of the removable plate, according to the author, are that they cause less tissue damage, produce an immediate influence on the jaw bones, are easy and economical to construct and produce less caries and periodontal damage.

The conservative treatment of caries is emphasized to prevent the development of malocclusion caused by early loss of deciduous teeth. Extractions are described in a special chapter. The last chapter describes the laboratory construction of the expansion plate and the Andresen appliance.

The book is based rather one-sidedly on the German literature. It would have gained in value if the Scandinavian, English and American literature had been given more consideration.

Nils A. Nordh

LIETFADEN DER KIEFERBRUCHBEHANDLUNG (GUIDE TO THE TREATMENT OF JAW FRACTURES)

By Erwin Reichenbach, Dr. Med. Dent. Sixth edition. 192 pages with 387 illustrations. Index. Price 14 German Marks. Leipzig, Germany, Johann Ambrosius Barth, 1954.

The first edition of this book was published in 1935 and since then the book has been revised several times. It is directed to the dental student as well as to the dentist in general practice who occasionally has to treat jaw fractures. Therefore, the author has laid particular stress on simplified treatment methods, and more complicated methods have been discussed superficially. This sixth edition has been revised and contains new illustrations. The discussion on jaw fractures of children has been expanded and has been put together in a special chapter.

The importance of careful examination and diagnosis is emphasized. Descriptions are given of complications which occur in connection with jaw fractures. The histology of healing is discussed as well as general principles for treatment of jaw fractures, types of instruments and appliances and fixation bandages for different types of fractures in dentulous and edentulous jaws.

Special difficulties encountered in the construction of good immobilization appliances for children who have mixed dentition are mentioned, and the author describes an acrylic splint for this purpose. A careful treatment of the soft tissue along with treatment of the fractures is emphasized.

The use of antibiotics is poorly described. As these agents play an important part in the treatment of jaw fractures, more space should be given to them.

References in the text are almost entirely confined to German literature, but at the end of the book there is a fine index of books and articles published since 1940 in Europe and America. The book is well written and easy to read and is a valuable contribution to the dentist who wants to know more in this specific field of dentistry.

Nils A. Nordh

L'INLAY A CRAMPONS ET SES APPLICATIONS

By Max Jeanneret. 270 pages with 243 illustrations. Index. Appendix. Price 2,100 F. Paris, Julien Prelat, 1953.

This is an excellent book about inlays and onlays. Prongs are used as the major means of retention. Max Jeanneret, by the use of a special type of instrument, has overcome the difficulties of parallelism of the prongs. This instrument can be installed in the mouth and can guide the handpiece or contra-angle in such a manner that the wells, made by very fine burs, are perfectly parallel. This device was designed by the author, and its use is supported by the 20 years' experience of its inventor. Special burs are used in the "Isodrome," as the device is called.

The author uses the Isodrome for different cavity preparations, inlays, three-quarter crowns, abutment teeth for bridges, different splints and long bridges.

This book has interesting material for persons concerned with restorative dentistry and may contain the answer to some everyday problems.

Hratch Abrahamian

FACIAL DEFORMITIES AND PLASTIC SURGERY: A PSYCHOSOCIAL STUDY

By Frances Cooke MacGregor, M.A.; Theodora M. Abel, Ph.D.; Albert Bryt, M.D., Edith Lauer, and Serena Weissmann, M.S. 230 pages with 4 illustrations. Index. Appendix. Price $5.75. Springfield, Ill., Charles C Thomas, 1953.

In this book directed to those interested in contributing to solutions of the problems of the facially disfigured, the authors are the first to deal professionally with the many aspects of facial disfigurement in our culture. The book is the result of interdisciplinary research conducted by specialists in cultural anthropology, clinical psychology, psychiatry and sociology.

The book is based on the concept that mild disfigurement as well as severe disfigurement have profound psychological effects. The personality structure of the individual and society's attitude toward disfigurement are crucial to the handling of the disfigurement.

The conclusions drawn are based on extensive individual interviews with facially disfigured children and adults and their families. Interviews were made before, during, and after plastic surgery. The sample contained a wide range of ages and socioeconomic groups. The surgical, social, psychological and economic ramifications of facial disfigurement are studied.

The book is written in clear comprehensive style, and throughout one is impressed with its simplicity and effectiveness. The list of references will be helpful to those who wish to study the subject in more detail.

E. Alan Lieban

PRACTICAL FULL DENTURE PROSTHESIS

By Joseph Simeon Landa, D.D.S., and two contributors. Second edition. 501 pages with 220 illustrations. Index. Price $9.50. Brooklyn, Dental Items of Interest Publishing Co., 1954.

The author's 40 years of practice provide a substantial background in complete denture prosthesis. This second edition consists of a reprinting of the first edition with little change beside the inclusion of six chapters of more recent material.

The new chapters on the freeway space, maxillomandibular opening and temporomandibular joint are presented logically. The chapter on correction of occlusal disharmony written by Schuyler and that on denture problems by Nagle are clear, concise and factual and are important additions to the text.

The author has neglected to eliminate discussion of obsolete technic and dental materials which in some instances were out of date even before the publication of the first edition in 1947. The superiority of vulcanite is mentioned, and examples given of the newer base materials include Iteco, Porcelite, Hecolite and Resovin. The word "plate" appears occasionally. Shellac bases are advised and although accuracy is stressed, methods of stabilization necessary to insure accuracy of registration of jaw position are not included, nor is the use of acrylic bases or trays described. The omission of a discussion of acrylic resins, including the self-curing type, in a modern text is particularly noticeable.

The immediate denture, which is so much a part of modern denture service, is discussed briefly. The author has placed emphasis on the inadequacy of the immediate denture instead of describing technics proved to be most successful.

In discussing esthetics, the author deplores the scarcity of literature on the subject and omits any mention of the recent developments of tooth forms in acrylic resins and porcelain.

In the two chapters relating to cleft palate prosthesis, the edentulous cleft palate is dismissed with one paragraph. The general practitioner will find this book helpful as a reference text and its complete bibliography an excellent source for further study.

Charles H. Jamieson

PRESENT KNOWLEDGE IN NUTRITION

Monograph prepared from articles published in the Nutrition Reviews, revised and edited by its editorial staff and advisory board. 122 pages. Price $2. New York, The Nutrition Foundation, Inc., 1953.

This monograph presents, in condensed form, information on various factors in the nutritive process. To the professional man it offers a way of quickly and accurately refreshing his knowledge in nutrition. The individual articles were originally developed by persons versed in the subject matter and experienced in research. Each article was brought up-to-date before assembling the whole in its present convenient form.

The monograph summarizes present nutritional knowledge in the following subject matter areas: calories, carbohydrates, protein, fat, nonprotein calories, parenteral nutrition, minerals, calcium, iron and copper, fluorine, vitamin A, vitamin D, vitamins E and K, ascorbic acid, thiamine, riboflavin, vitamin B_6, pantothenic acid, biotin, folacin, vitamin B_{12}, citrovorum factor, methyl groups, lipoic acid, vitamin-enzyme relationship and the relation of nutrition to dental caries.

Research in the relation of nutrition to dental caries is reviewed. Various theories are described, and considerable space is given to a discussion of the ways in which a tooth is nourished. No effort is made to draw conclusions for the reader. However, in a final statement, the authors point out that, from a strictly nutritional standpoint, adequate amounts of vitamin D and the adequate retention of calcium and phosphorus have been demonstrated to aid in the maintenance of a low incidence of tooth decay.

The authors add that the fluoride content of drinking water may be another factor which influences dental caries incidence. In a final statement they urge that "every effort should be made to apply these facts to nutritional programs with the knowledge that definite beneficial results on dental caries incidence can be expected."

E. A. Martin

PLASTIC SURGERY AT THE NEW YORK HOSPITAL 100 YEARS AGO

By Herbert Conway, M.D., and Richard B. Stark, M.D. 110 pages with illustrations and bibliography. Price $5. New York, Paul B. Hoeber, Inc., 1953.

This is the story of the development of plastic surgery in the middle of the nineteenth century with a brief biographical sketch of Gurdon Buck, a surgeon of that period. Dr. Buck is best known for "Buck's extension," a procedure which used traction in the treatment of fractures of the femur. His book *Contributions To Reparative Surgery* published in 1876 established him as a pioneer in reconstructive surgery.

The treatise contains several detailed descriptions by Dr. Buck of various operative technics for plastic reconstruction of the face. One case report deals with the repair of maxillofacial tissue extensively destroyed by gangrene. Dr. Buck generously acknowledges his reliance on "Mr. Thomas B. Gunning, a skillful dentist" for the construction of an ingenious appliance for the patient. This preoperative prosthesis was indispensable to the treatment plan, and Dr. Buck describes its design and function in highly complimentary terms.

Dr. Buck outlined principles for the use of relaxation incisions, pedicle flaps and the rotation and advancement of soft tissue flaps. He advocated the use of multiple, fine sutures and practiced their early removal. His approach to the problems of plastic repair may be considered fundamental to modern concepts of treatment.

This book will make enjoyable reading for those interested in the historical background of surgery in the Civil War era. Despite the limitations of knowledge and experience of those days, the results achieved deserve our admiration and respect.

James Springer

Current Literature

THE ATTACHMENT OF THE MUSCLES OF MASTICATION

N.B.B. Symons. Brit. D.J. 96:76 Feb. 16, 1954.

During skeletal growth, considerable adjustment occurs in the attachment of the muscles of mastication. Little attention has been paid to this fact.

Classified according to their attachments, muscles are of two groups: (a) fleshy attachments, easily stripped from the bones and attached solely to the fibrous layer of the periosteum and (b) tendinous attachments, which are difficult to remove from the bone without surface destruction of bone.

The method by which shifting of the attachments is accomplished in Group a muscles was discussed as early as 1861. The method of shifting of the attachment in Group b muscles is less clear. Human fetuses of more than three months provided the source material for this study.

A study of the lateral pterygoid muscles, suprahyoid muscles, and temporal and medial pterygoid muscles indicates that continual adjustments must be made to the attachments of these muscles during skeletal growth. When the attachments are tendinous, there must be a continual process of breaking down and restoration.

It is possible that bone resorption and bone deposition are the means by which these adjustments are made during the period of growth.

Donovan W. Brown

TOOTH EXTRACTION IN THE TREATMENT OF THE CROWDED DENTAL ARCH

J. G. Suckling. New Zealand D. J. 50:3 Jan. 1954.

A thorough analysis is necessary before a decision is made to extract permanent teeth in orthodontic therapy.

In cases of crowded dental arches, determinations are made of (1) the amount of additional spaces required, (2) the location of the crowding, (3) the physical condition of the teeth, (4) the condition of the periodontium, (5) the axial inclination, (6) the direction of normal migration and (7) esthetics.

In the consideration of occlusion as a whole, the following factors must be taken into account: (1) the effect of the extraction on the size of the opposing arch, (2) the resulting cuspal interdigitation, (3) the effect of extraction on overbite and (4) the anteroposterior relation of the arches.

Continued observation and, if necessary, additional treatment are essential after such extractions.

Charles R. Baker

SYNCHRONIZING GROWTH AND TREATMENT IN ORTHODONTICS

J. F. A. Harding. New Zealand D. J. 50:16 Jan. 1954.

In determining the correct time for orthodontic treatment, the natural growth changes which occur during the development of the dental apparatus must be kept in mind. The following conditions may require treatment: size disharmonies, form disharmonies, functional displacements and some muscular conditions.

Size disharmony may be noted when anterior teeth are crowded. Room for these teeth may be obtained by increasing the width of the arches, by increasing the length of the arches, or by reducing the number of teeth. Changes in the dental arches resulting from growth will indicate the correct form of treatment. When incisors first erupt in a crowded condition, the time is suitable for expansion procedures, provided that this increase in the width of the arches does not exceed the natural potential of growth.

Moving first permanent molars distally may inhibit the eruption of, or limit the space necessary for, other molar teeth. In cases where the arches and alveolar tissues seem inadequate to support the teeth in ideal positions, it is usually necessary to remove some of the teeth; the removal of the first bicuspids is preferred.

Disharmonies in form are expressed in occlusal terms as Angle Class II and Class III malocclusions. There are many morphological variations that produce these malocclusions. Each patient has an individual growth pattern and will show a typically individual response to a treatment stimulus. When these malocclusions occur in the deciduous dentition, early treatment may be advisable.

The great majority of children whose lips

are apart when the jaws are in rest position are not mouth breathers. The size and position of the labial, buccal and lingual muscles are related to the size of the jaws; the teeth are in equilibrium between these groups of muscles. Movement of the teeth out of the region of equilibrium will result in the production of an unstable occlusion. In Angle Class II and Class III conditions, orthodontic treatment usually can affect only the teeth and alveolar bone; it is difficult or impossible to alter basic facial features.

Charles R. Baker

EXPERIMENTAL DENTAL CARIES
V. THE EFFECT OF DESALIVATION AND CASTRATION ON CARIES AND FLUORINE STORAGE IN THE RAT

David Bixler, Joseph C. Muhler and William G. Shafer. J. Nutrition 52:345 March 10, 1954.

Approximately 150 rats (Sprague-Dawley) were divided into four groups when they were 25 to 27 days old; the groups were about equal as to sex and weight. The submaxillary glands, the sublingual glands and the greater portion of the parotid glands were removed from the rats in one group, the rats in the second were castrated, those in the third group were both desalivated and castrated, and those in the fourth group served as controls. All animals were placed on a cariogenic diet (Muhler and Day) with a dietary fluorine concentration of 0.3 ppm and were given distilled water. Food and water were available at all times. After 140 days, the animals were killed by ether inhalation; the heads and femurs were analyzed.

There was a significant reduction in caries in the castrated animals. There was about 60 per cent increase in caries in the desalivated animals, the number of lesions and the severity of caries being considerably greater than in the control animals. In the group of rats both desalivated and castrated, the cariogenic effect was noticeably reduced, but the severity of the lesions was similar to that of the desalivated group. The desalivated and castrated animals stored less fluorine than control animals. Because it was thought that the reason for the difference might be that less food was ingested by the experimental animals, a feeding experiment of paired animals was conducted.

Although the two groups ingested the same amount of food, the desalivated animals still gained less than the control animals. Data indicate that the storage of fluorine is dependent on the rate of growth as well as on food intake; that metabolism of calcium, phosphorus or fluorine is influenced by the amount of food ingested and by the rate of growth as well as by the endocrine system.

Dorothea F. Radusch

THE JOURNAL OF DENTAL RESEARCH

October 1954

THE METALLOGRAPHY OF DENTAL AMALGAM ALLOYS

Walter S. Crowell, p. 592.

AN INVESTIGATION OF THE PHYSICAL PROPERTIES OF SALIVA AND THEIR RELATIONSHIP TO THE MUCIN CONTENT

Margaret R. Dewar and G. J. Parfitt, p. 596.

Several physical properties characteristic of nonNewtonian fluids, such as anomalous viscosity, flow elasticity, tack, and spinnbarkeit, are described, and methods for measuring them are reported. Evaluations of methods for determining mucin content of saliva indicated that tyrosine estimation and a modified A.C.R.A. test gave satisfactory results on suitable samples.

Measurements on 700 samples of saliva made within one hour of secretion revealed some relationship between viscosity, spinnbarkeit, and the content of polymerized mucin as measured by the A.C.R.A. titer. No relation of these physical properties to tyrosine content or tack was found.

Variations in all properties were noted from time to time during the day and also from day to day in the same individuals. It appears that the methods of collecting and treating salivary samples are of great importance in studies of salivary properties.

THE EFFECT OF A STANNOUS FLUORIDE-CONTAINING DENTIFRICE ON CARIES REDUCTION IN CHILDREN

Joseph C. Muhler; Arthur W. Radike, William H. Nebergall and Harry G. Day, p. 606.

A stannous fluoride-containing dentifrice at a fluorine concentration of 1,000 ppm and a tin concentration of 3,200 ppm results in a pronounced reduction in dental caries in 6 to 15 year old children who have used the dentifrice in an unsupervised manner for a period

of six months. When compared with the results obtained from the use of the control dentifrice (identical with the experimental dentifrice except that it contained no stannous fluoride), a 53 per cent reduction in DMF teeth and a 72 per cent reduction in DMF surfaces was found. There appeared to be complete protection against interproximal lesions; the reduction in lesions on the buccolingual surfaces was 70 per cent and that on occlusal surfaces 26 per cent. All of the reductions are highly significant except the reduction on the occlusal surfaces. The reduction of caries appears to be related to the age of the subjects, with the greatest protection occurring in the older age groups. Possible toxic effects resulting from the continued use of a stannous fluoride dentifrice are discussed.

DISTRIBUTION OF DENTAL CARIES IN CHILDREN

R. M. Grainger and D. B. W. Reid, p. 613.

The frequency distributions of dental caries among 1,200 school children of various ages were examined statistically. The frequency distributions for smooth surface caries could be described by a negative binomial curve. The distribution of counts of carious pitted surfaces could not be described generally by any common probability distribution, although at some ages the counts tended to follow the binomial pattern. The fit of these distributions to dental caries scores supports the concept that caries is a chance process involving some measure of differing individual susceptibility. Variation in the caries scores of pitted and smooth surfaces may arise from different sources, the variation scores of pitted surfaces depending considerably on the morphology of the tooth at the time of eruption and those of smooth surfaces to a greater extent on conditions affecting the tooth after eruption. By using the first term of the negative binomial distribution, the average number of affected smooth surfaces per child may be estimated from the observed proportion of children whose teeth are free of decay.

TISSUE DESTRUCTIVE PRODUCTS OF GINGIVAL BACTERIA FROM NONSPECIFIC GINGIVITIS

S. Schultz-Haudt, B. G. Bibby and M. A. Bruce, p. 624.

The presence of agents capable of attacking hyaluronic acid, chondroitin sulfate and a collagen preparation (Azocol) have been demonstrated in most of 28 bacteria-free filtrates prepared from gingival deposits obtained from individuals with various degrees of gingival inflammation.

The active substances were not found in filtrates prepared from gingival deposits removed from individuals with normal gingiva. Histamine could not be detected in extracts of gingival deposits from patients with gingivitis or in extracts of inflamed gingival tissues. Several microorganisms isolated from gingival pockets of individuals with gingivitis were shown to be capable of producing hyaluronidase and protease.

NITROGEN CONTENT OF DENTAL PULP

Marvin L. Riedesel and Alton K. Fisher, p. 632.

The individual dental pulp has not been the subject of extensive quantitative physiological study. Micromanometric investigations of respiratory activity require tissue samples of such small size that routine gravimetric determinations of mass are difficult. Total nitrogen has been used as a standard of reference for other tissues, and it was decided to determine its concentration in dental pulp by macroKjeldahl, microKjeldahl and nesslerization methods. Because fresh pulp is not always available for analysis, the effect of Formalin preservation on nitrogen analysis was considered also.

Tissues studied were normal bovine pulps from animals between two and three years old, human infant pulps secured at autopsy and pulps of normal teeth from patients between 14 and 48 years old. Results of 304 total nitrogen determinations are reported.

Bovine pulps were removed from the teeth, dried or fixed in ten per cent Formalin and then dried. Nitrogen content of fresh and preserved tissues determined by macroKjeldahl and microKjeldahl methods was not significantly different. Analysis by nesslerization yielded slightly lower nitrogen values but the difference between fresh and preserved pulps was negligible. Formalin-preserved human infant and adult pulps analyzed by the microKjeldahl method showed almost identical nitrogen contents.

The mean total nitrogen of human dental pulp as determined by the Kjeldahl method was observed to be 0.1050 mg. per microgram of dried tissue and that of bovine pulp 0.1258 mg.

Deaths

Aiken, William R., Asheville, N. C.; Atlanta-Southern Dental College, 1927; died October 26; aged 54.

Bachman, Morton W., Upper Darby, Pa.; Pennsylvania College of Dental Surgery, Philadelphia, 1903; died November 5; aged 78.

Baker, Lawrence W., West Roxbury, Mass.; Dental School, Harvard University, 1898; died November 28; aged 78.

Baldwin, Harrison P., Manchester, N. H.; Pennsylvania College of Dental Surgery, Philadelphia, 1900; died November 22; aged 84.

Barr, Abner C., Alton, Ill.; Western Dental College, Kansas City, 1892; died November 13; aged 83.

Beale, Rupert G., Philadelphia; Pennsylvania College of Dental Surgery, 1890; died November 8; aged 86.

Bohan, Edward T., Wilkes-Barre, Pa.; School of Dentistry, University of Pennsylvania, 1919; died November 7; aged 60.

Boland, Frank W., Yeadon, Pa.; School of Dentistry, Temple University, 1918; died December 3; aged 68.

Breslin, John L., Watertown, Mass.; died October 30; aged 71.

Burke, Nathan L., Grand Rapids, Mich.; Dental School, Northwestern University, 1897; died November 16; aged 82.

Callahan, William C., Johnstown, N. Y.; Baltimore College of Dental Surgery, 1892; died November 7; aged 84.

Carpenter, Edgar B., Boise, Idaho; College of Dentistry, Ohio Medical University, 1905; died October 30; aged 72.

Channing, Raymond E., Fitchburg, Mass.; Dental School, Tufts College, 1907; died October 29; aged 69.

Christensen, Francis N., Wenatchee, Wash.; School of Dentistry, North Pacific College of Oregon, Portland, 1912; died September 30; aged 63.

Coe, John Wallace, Chattanooga, Tenn.; Atlanta-Southern Dental College, 1919; died October 21; aged 62.

Cohan, Israel, Albany, N. Y.; Dental School, Tufts College, 1927; died November 24; aged 62.

Conroy, Cecil R., Belleville, Ill.; College of Dentistry, University of Illinois, 1917; died November 19; aged 58.

Cooley, Ralph C., Leander, Texas; Texas Dental College, Houston, 1909; died November 2; aged 65.

Craig, Robert M., Stoystown, Pa.; died November 14; aged 80.

Crawford, Glen A., Grand Rapids, Mich.; Kansas City Dental College, 1896; died November 22; aged 76.

Crow, Frank L., Carmichaels, Pa.; Pittsburgh Dental College, Western University of Pennsylvania, 1899; died October 23; aged 86.

Cummings, Thomas F., Bridgeport, Conn.; Baltimore College of Dental Surgery, University of Maryland, 1909; died November 10; aged 74.

Cutliff, Jerre G., Albany, Ga.; School of Dentistry, Vanderbilt University, 1891; died November 5; aged 85.

Donner, Walter D., Cleveland; College of Dentistry, Western Reserve University, 1929; died October 31; aged 47.

Duffee, Walter S., Derry, N. H.; Dental School, Tufts College, 1908; died November 24; aged 74.

Ellis, Paul J., Chagrin Falls, Ohio; College of Dentistry, Western Reserve University, 1952; died November 23; aged 31.

Evans, Frederick E., Sacramento, Calif.; College of Physicians and Surgeons, San Francisco, 1916; died October 31; aged 65.

Eves, Paul W., Berwick, Pa.; School of Dentistry, Temple University, 1913; died November 6; aged 63.

Farrell, Harry L. A., Houston, Texas; Barnes Dental College, St. Louis, 1916; died November 27.

Fink, Harry S., Brooklyn; New York College of Dentistry, 1914; died September 26; aged 64.

Garr, James Robin, Louisville, Ky.; Louisville College of Dentistry of Centre College, 1900; died October 28; aged 76.

Garrett, Hugh, Beebe, Ark.; Louisville College of Dentistry of Centre College, 1902; died November 21; aged 71.

Gensley, William H., Cincinnati; Cincinnati College of Dental Surgery, 1895; died November 29; aged 90.

Gill, Bert R., Rexburg, Idaho; School of Dentistry, North Pacific College of Oregon, Portland, 1916; died November 26; aged 65.

Grimley, John J., Bristol, Conn.; Dental Department, Baltimore Medical College, 1908; died November 12.

Gunn, Robert J., Corvallis, Ore.; College of Dentistry, University of Illinois, 1905; died November 5; aged 72.

Hall, A. Beverly, San Dimas, Calif.; died November 10.

Hampton, Charles G., Detroit; College of Dental Surgery, University of Michigan, 1900; died November 13; aged 82.

Hillias, George W., Kansas City, Mo.; Western Dental College, Kansas City, 1901; died November 19; aged 84.

Hobart, Charles M., Brownsburg, Ind.; School of Dentistry, Indiana University, 1925; died November 2; aged 52.

Hoffman, Walter A., Jersey City; New York College of Dentistry, 1910; died December 2.

Hovsepian, Martin B., Philadelphia; School of Dentistry, Temple University, 1930; died December 15; aged 50.

Huff, Herbert W., Wharton, N. J.; Baltimore College of Dental Surgery, 1914; died November 21; aged 65.

Jacques, Edgar J., Manchester, N. H.; Baltimore College of Dental Surgery, 1917; died November 30; aged 59.

Jenney, Edward B., Rutland, Vt.; School of Dentistry, University of Pennsylvania, 1921; died November 18; aged 56.

Johnson, Benton R., Spartanburg, S. C.; Atlanta-Southern Dental College, 1928; died November 25; aged 49.

MacDonald, John R., Chicago; Dental School, Northwestern University, 1901; died June 13; aged 86.

Mahoney, Patrick, Burlington, Vt.; Pennsylvania College of Dental Surgery, Philadelphia, 1901; died September 10; aged 80.

Maland, James W., Minneapolis; College of Dentistry, University of Minnesota, 1910; died March 14, 1954.

Mangouney, Abraham, Boston; Dental School, Tufts College, 1928; died October 16; aged 64.

Martin, John J., Des Moines, Iowa; College of Dentistry, University of Iowa, 1916; died September 10; aged 67.

Matzinger, James E., Lockhart, Fla.; College of Dentistry, Western Reserve University, 1912; died September 18; aged 72.

McVay, Irwin E., Forks, Wash.; died October 5; aged 76.

Merrell, George B., Philipsburg, Pa.; Pennsylvania College of Dental Surgery, Philadelphia, 1903; died September 29; aged 74.

Miller, Henry L., Brooklyn; Pennsylvania College of Dental Surgery, Philadelphia, 1902; died September 5; aged 77.

Milligan, Charles C., New York; New York College of Dentistry, 1898; died September 12; aged 77.

Moore, Walter L., Franklin Grove, Ill.; School of Dentistry, University of Buffalo, 1904; died July 14; aged 76.

Olp, Frederick G., Marysville, Mich.; Chicago College of Dental Surgery, Loyola University, 1891; died August 29; aged 84.

Owen, Lawrence E., Miami, Fla.; Atlanta-Southern Dental College, 1920; died October 18; aged 61.

Parmenter, Roy W., Kansas City, Mo.; Kansas City Dental College, 1909; died October 19; aged 69.

Parry, Oswald D., Los Angeles; College of Dentistry, University of Southern California, 1923; died April 26, 1954; aged 53.

Peach, James H., Spokane, Wash.; School of Dentistry, North Pacific College of Oregon, Portland, 1935; died September 7; aged 42.

Penman, William J., Tecumseh, Mich.; Department of Dental Surgery, Detroit College of Medicine, 1900; died September 26; aged 76.

Petter, Alvin L., Stuttgart, Ark.; Indiana Dental College, 1915; died September 14; aged 63.

Phillips, Edward A., Selinsgrove, Pa.; School of Dentistry, University of Pittsburgh, 1923; died October 16; aged 59.

Phillips, Henry H., New York; Philadelphia Dental College, 1902; died October 19; aged 75.

Pinkerton, Robert H., Toledo, Ohio; College of Dentistry, Ohio State University, 1918; died October 20.

Powell, Vernon H., Lake Charles, La.; Dental Department, Meharry Medical College, 1938; died September 23; aged 44.

Ray, Herbert S., Chicago; Dental School, Northwestern University, 1918; died August 17, aged 59.

Reedy, George L., Forestville, Calif.; College of Dentistry, University of California, 1926; died September 28; aged 50.

Rowley, Roy C., Pasadena, Calif.; Dental Department, Milwaukee Medical College, 1904; died September 9; aged 72.

Rudin, Nathan, Mount Vernon, N. Y.; New York College of Dentistry, 1915; died September 17; aged 67.

Saxton, Guy B., Toledo, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1894; died September 7; aged 84.

Stone, Thomas A., Ridgeville, Ind.; Louisville College of Dentistry of Centre College, 1903; died September 29; aged 75.

Tinsley, Robert B., Unity, Pa.; School of Dentistry, University of Pittsburgh, 1912; died October 1; aged 67.

Waggoner, William G., Hamlin, W. Va.; died September 21; aged 47.

Weikert, William H., Fort Dodge, Iowa; College of Dentistry, University of Iowa, 1898; died May 8.

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Sixth Annual Session	Oct. 17-20, 1955	San Francisco
Ninety-Seventh Annual Session	Oct. 1-4, 1956	Atlantic City, N. J.
Ninety-Eighth Annual Session		Miami, Fla.
Ninety-Ninth Annual Session		Dallas, Texas.
One-Hundredth Annual Session		New York

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 4, 5	Birmingham	F. A. Finney, Jr.	1045 Forrest Ave., Gadsden
Alaska	June 26-30	Juneau	R. M. MacKenzie	207 Mendenhall Apts., Juneau
Arizona	Apr. 27-30	Grand Canyon	R. W. Christensen	17 E. Weldon Ave., Phoenix
Arkansas	Apr. 3-6	Little Rock	D. M. Hamm	Box 89, Clarksville
California	Apr. 16	San Francisco	L. R. Ludwigsen	450 Sutter St., San Francisco
S. California	May 9-11	Los Angeles	J. P. Bowers	124 W. Lime Ave., Monrovia
Colorado	Oct. 2-5	Colorado Springs	W. R. Humphrey	724 Republic Bldg., Denver
Connecticut	May 18-20	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			R. V. Reed, Jr.	Medical Arts Bldg., Wilmington
District of Columbia	June 14	Washington	Z. B. Lloyd	2007 R St., N.W., Washington
Florida	Apr. 24-27	Jacksonville	J. E. Edwards	152 Alhambra Circle, Coral Gables
Georgia	Oct. 2-5	Atlanta	J. W. Yarbrough	Bibb Bldg., Macon
Hawaii	June 15-18	Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	May 19-21	Coeur d'Alene	F. O'Halloran	Box 703, Coeur d'Alene
Illinois	May 9-12	Peoria	P. W. Clopper	623 Jefferson Bldg., Peoria
Indiana	May 16-18	Indianapolis	D. C. Barnhill	400 Bankers Trust Bldg., Indianapolis
Iowa	May 1-4	Des Moines	H. I. Wilson	639 Insurance Exchange Bldg., Des Moines
Kansas	May 15-18	Kansas City, Mo.	F. A. Richmond	861 Brotherhood Bldg., Kansas City
Kentucky	Apr. 18-21	Louisville	A. B. Coxwell, Jr.	1975 Douglass Blvd., Louisville
Louisiana	Apr. 13-16	New Orleans	J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 23-25	Rockland	S. M. Gower	Box 27, Skowhegan
Maryland	May 2-4	Baltimore	E. L. Pessagno, Jr.	415 Medical Arts Bldg., Baltimore
Massachusetts	May 1-4	Boston	H. E. Tinsley	12 Bay State Rd., Boston
Michigan	Apr. 18-20	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Mar. 28-30	Minneapolis	C. V. E. Cassel	225 Hamm Bldg., St. Paul
Mississippi	Apr. 24-27	Jackson	B. A. Cohen	306 Plaza Bldg., Jackson
Missouri	May 15-18	Kansas City	E. D. Sugget	201 Merchants Bank Bldg., Jefferson City
Montana	May 5-7	Bozeman	E. G. Vedova	Roundup
Nebraska	May 9-12	Lincoln	F. A. Pierson	1112 Federal Securities Bldg., Lincoln
Nevada	June 10-12	Lake Tahoe	O. M. Seifert	506 Humboldt St., Reno
New Hampshire	June 12-14	Whitefield	F. E. Williams	814 Elm St., Manchester
New Jersey	Apr. 18-20	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 22-25	Ruidosa	J. S. Eilar	Medical Arts Square, Albuquerque
New York	May 16-19	New York	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina	May 15-18	Pinehurst	R. D. Coffey	Kibler Bldg., Morganton
North Dakota	May 1-4	Grand Forks	V. B. Keltgen	517 de Lendrecie Bldg., Fargo
Ohio	Nov. 13-16	Cleveland	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 20	Tulsa	S. A. Russman	809 Medical Arts Bldg., Oklahoma City
Oregon	Mar. 7-9	Portland	T. D. Holder	308 Selling Bldg., Portland
Panama Canal Zone			A. L. Teitel	Box D, U.S. Naval Station, odman
Pennsylvania	May 16-18	Philadelphia	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico			M. A. Russo	Box 9023, San Juan
Rhode Island	Jan. 17, 18, 1956	Providence	W. D. MacIntosh	506 Industrial Bank Bldg., Providence
South Carolina	May 22-24	Charleston	J. R. Owings	7 Medical Court, Greenville

State	Date	Place	Secretary	Address
South Dakota	May 15-17	Aberdeen	L. N. Thelen	229 S. Prairie St., Sioux Falls
Tennessee	May 8-12	Nashville	A. M. Ballentine	Pulaski
Texas	May 1-5	San Antonio	W. Ogle	3607 Gaston Ave., Dallas
Utah	Apr. 21-23	Ogden	R. C. Dalgleish	124 State Capitol Bldg., Salt Lake City
Vermont	May 30-June 1	Manchester	W. J. Reardon	18 Madison St., Rutland
Virginia	Apr. 29-May 6	Havana, Cuba	W. T. McAfee	705 Colonial National Bank Bldg., Roanoke
Washington	Mar. 24-26	Seattle	W. B. Martin	Medical-Dental Bldg., Seattle
West Virginia	July 24-27	White Sulphur Springs	G. N. Canto, Jr.	710½ Lee St., Charleston
Wisconsin	Apr. 25-27	Milwaukee	A. E. Kopp	Wells Bldg., Milwaukee
Wyoming	June 16-18	Cheyenne	T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama	June 20-24* June 20, 21†	Birmingham	W. L. McCarty	200 Professional Center, Montgomery
Alaska			R. H. Williams	Box 2122, Juneau
Arizona	June 20-26*†‡		R. K. Trueblood	107 East A Ave., Glendale
Arkansas	June 20-24*†	Little Rock	H. O. Weatherly	205 Halter Bldg., Conway
California	June 20	Los Angeles	T. E. Tiden	Medico-Dental Bldg., Sacramento
	July 25	San Francisco		
Colorado	June 20-24	Denver	J. M. Peabody	724 Republic Bldg., Denver
Connecticut			C. G. Brooks	302 State St., New London
Delaware	June 27-29	Wilmington	P. K. Musselman	143 W. Main St., Newark
District of Columbia			W. T. Birthright	Suite 718, 1835 Eye St., N.W., Washington
Florida	July 11-21*†	Jacksonville	A. W. Kellner	P. O. Box 155, Hollywood
Georgia			P. M. McNeil	307 First National Bank Bldg., Rome
Hawaii			H. L. Houvener	427 Dillingham Bldg., Honolulu
Idaho			R. E. Blickenstaff	1023 Fourth St., S., Nampa
Illinois			W. A. McKee	503 Wood Bldg., Benton
Indiana	June 14-17*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	May 23-27‡		D. J. FitzGerald	615 Brick & Title Bldg., Mason City
Kansas	June 6-9	Kansas City, Mo.	G. L. Teall	Box 71, Hiawatha
Kentucky	June 6-9	Louisville	R. M. Justice	1330 Central Ave., Ashland
Louisiana	June 5-10	New Orleans	R. C. Steib	833 Maison Blanche Bldg., New Orleans
Maine			R. A. Derbyshire	Box 387, Skowhegan
Maryland	June 6-8‡		H. Levin	3429 Park Heights Ave., Baltimore
Massachusetts	June 13-16*† June 15, 16†‡		G. J. Fink	Rm. 33, State House, Boston
Michigan	June 5-11	Ann Arbor	J. L. Champagne	3714 W. McNichols Rd., Detroit
Minnesota	June 13-17*†‡		M. G. Walls	615 Montcalm Place, St. Paul
Mississippi	June 21-23	Jackson	J. C. Boswell	508 Lamar Life Bldg., Jackson
Missouri	June 13-18	St. Louis Kansas City	R. R. Rhoades	414 Central Trust Bldg., Jefferson City
Montana	July 11-14*†	Helena	V. J. Quinn	301 Phoenix Bldg., Butte
Nebraska	June 13	Lincoln	H. E. Weber	1210 Federal Securities Bldg., Lincoln
Nevada			R. Whitehead	Suite 6, Masonic Temple, Reno
New Hampshire	June 17,18 June 17†‡	Boston	S. G. Markos	8 Renaud Ave., Dover
New Jersey	May 25-26* June 1, 2* June 8, 9*† June 13, 14*	Washington, D.C. Philadelphia New York Trenton	W. A. Wilson	150 E. State St., Trenton
New Mexico			J. J. Clarke, Sr.	Artesia
New York			D. W. Beier	23 S. Pearl St., Albany
North Carolina	June 27-July 1	Chapel Hill	F. O. Alford	1107 Liberty Life Bldg., Charlotte
North Dakota	June 20-24	Fargo	A. L. Pushor	Lisbon
Ohio	June 16-18 June 20-22	Columbus	H. B. Smith	322 E. State St., Columbus
Oklahoma	June 16-18‡		R. P. Keidel	403 Surety Bldg., Muskogee
Oregon	June 6-9*†	Portland	F. L. Utter	506 Pioneer Trust Bldg., Salem

State	Date	Place	Secretary	Address
Pennsylvania	June 20-25	Philadelphia	A. M. Stinson	Dept. of Public Instruction, Box 911, Harrisburg
Puerto Rico	June 20-22	Pittsburgh	J. Mercado C.	Box 3717, Santurce
Rhode Island			F. M. Hackett	267 Academy Ave., Providence
South Carolina			T. C. Sparks	1315 Pickens St., Columbia
South Dakota			H. T. Aker	Canton
Tennessee			C. R. Alta	619 Bennie Dillon Bldg., Nashville
Texas			R. T. Weber	312 Capital National Bank Bldg., Austin
Utah	June 27-July 2	Salt Lake City	D. L. Folsom	1101 First Security Bank Bldg., Salt Lake City
Vermont	June 27-29	Burlington	P. M. Fitch	Newport
Virginia	June 6-11*	Richmond	J. M. Hughes	715 Medical Arts Bldg., Richmond
	June 6, 7†			
Washington			M. L. Mower	National Bank of Commerce Bldg., Olympia
West Virginia	June 20-22*†	West Liberty	C. A. Laughlin	613 Prunty Bldg., Clarksburg
Wisconsin	June 13-17*†	Milwaukee	S. F. Donovan	Tomah
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Most states require applications to be in 30 days prior to examination date.

*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations. §Approximate dates—verify with state dental examining board

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	May 1-8	New York	I. L. Furnas Secy.	928 Silverado St., La Jolla, Calif.
American Academy of Dental Medicine	May 13-15	New York	W. M. Greenhut Secy.	124 E. 84th St., New York
American Association of Dental Schools	Mar. 20-23	Chicago	M. W. McCrea Secy.	Baltimore College of Dental Surgery, University of Maryland, Baltimore
American Association of Industrial Dentists	Apr. 26-28	Buffalo	E. R. Aston Secy.	South Office Bldg., Harrisburg, Pa.
American Dental Society of Europe	July 11-14	Amsterdam, Netherlands	J. Moloney Hon. Secy.	110 Harley St., London, England
British Dental Association	July 4-8	Glasgow, Scotland	H. P. Buchanan Secy.	13 Hill St., Berkeley Square, London, England
Chicago Dental Society	Feb. 5-8, 1956	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Cincinnati Dental Society Clinic	Mar. 27-29	Cincinnati	W. C. Jolly Secy.	403 Tracton Bldg., Cincinnati
Council on Dental Education, Dental Aptitude Tests	Apr. 29, 30		S. Peterson Secy.	222 E. Superior St., Chicago
District of Columbia Postgraduate Clinic	Mar. 13-16	Washington, D.C.	E. M. Colvin, Jr. Gen. Chm.	1726 21st St., N.W., Washington, D.C.
Federation Dentaire Internationale	Aug. 14-20	Copenhagen, Denmark	G. H. Leatherman Secy. Gen.	35 Devonshire Place, London, England
First Congress of Oral Surgery of Cuba	Apr. 25, 26	Havana, Cuba	P. Garcia Secy.	Edificio Retiro Odontologico, Calle L No. 353, Vedado, Havana, Cuba
International Association for Dental Research	Mar. 18-20	Chicago	E. H. Hatton Secy.	2419 Simpson St., Evanston, Ill.
National Board of Dental Examiners	Mar. 28, 29		G. J. Casey Secy.	222 E. Superior St., Chicago
Northeastern Dental Society	June 5-8	Swampscott, Mass.	M. J. Frasca Secy.	153 Cabot St., Beverly, Mass.
Northeastern Society of Orthodontists	Mar. 7, 8	New York	W. J. Pressano Secy.	Medical Center, White Plains, N. Y.
Paraguay National Dental Week	Mar. 9-12	Asuncion, Paraguay	C. G. Torreani Secy.	Casilla de Correo 565, Asuncion, Paraguay
Seminario Anual del Grupo de Estudios Dentales U. S. C. de Mexico	May 15-19	Tehuacan, Puebla, Mex.	R. S. deLascurain Secy.	Insurgentes 257-10, Mexico, D.F.
Sixth Annual Berkshire Conference	June 19-23	Lenox, Mass.	I. Glickman Dir.	Tufts College Dental School, 136 Harrison Ave., Boston
Southeastern Society of Oral Surgeons	Apr. 22,23	Havana, Cuba	J. E. Skaggs Secy.	509 Francis Bldg., Louisville, Ky.
Southern Academy of Oral Surgery	Mar. 19, 20	Chattanooga, Tenn.	R. F. Sullivan Secy.	118 Jones St., E., Savannah, Ga.

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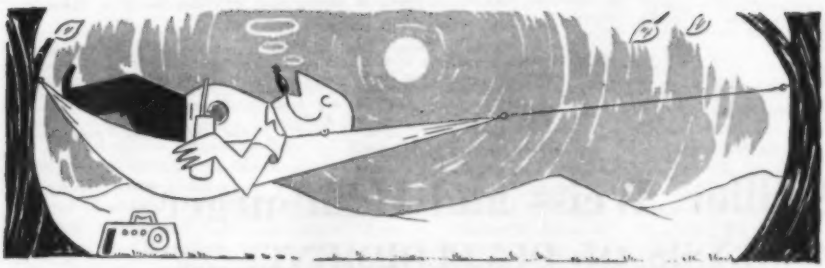

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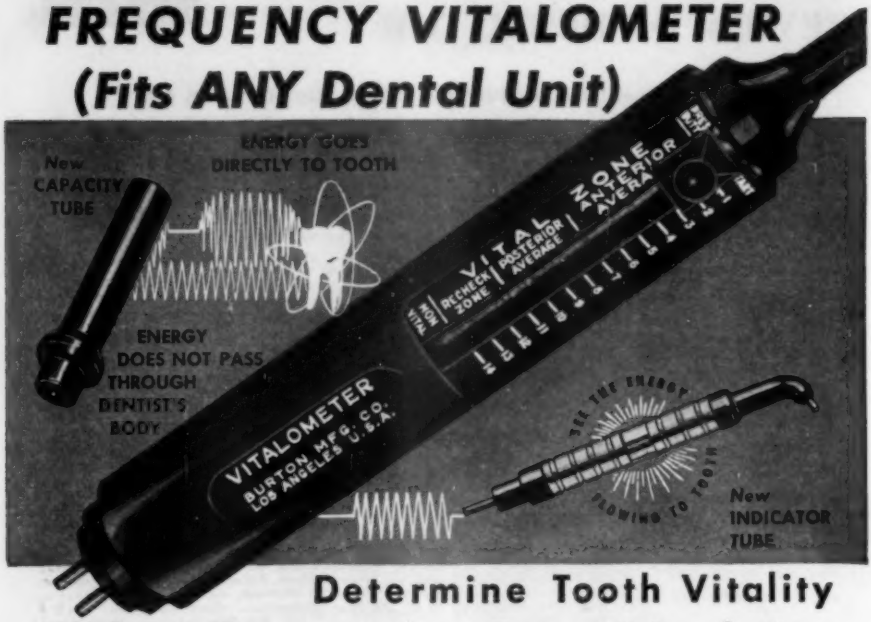

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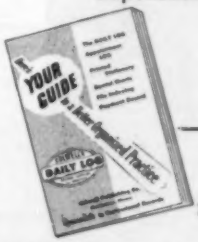

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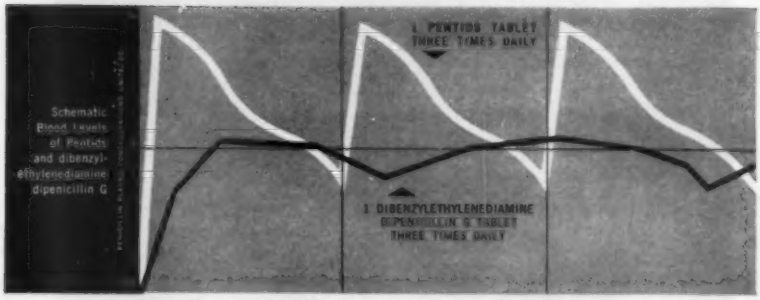

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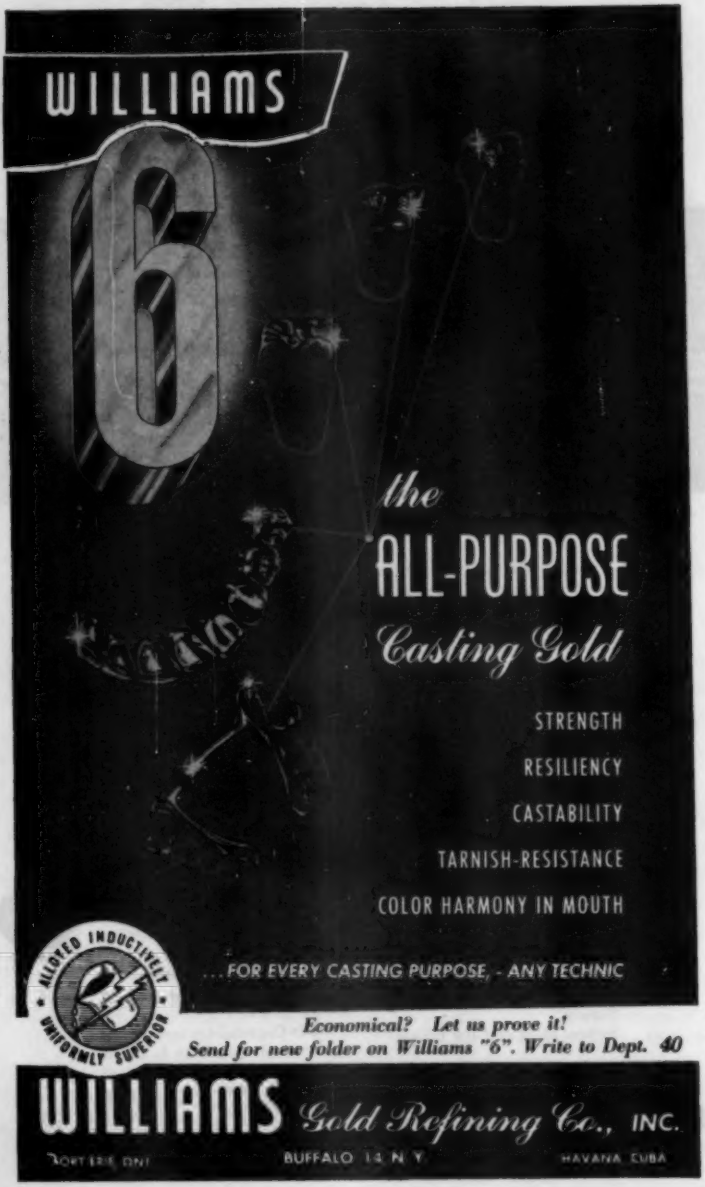
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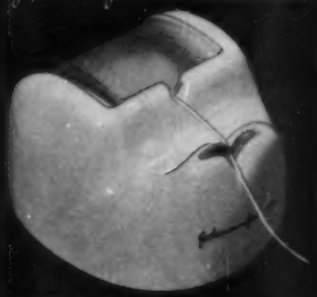

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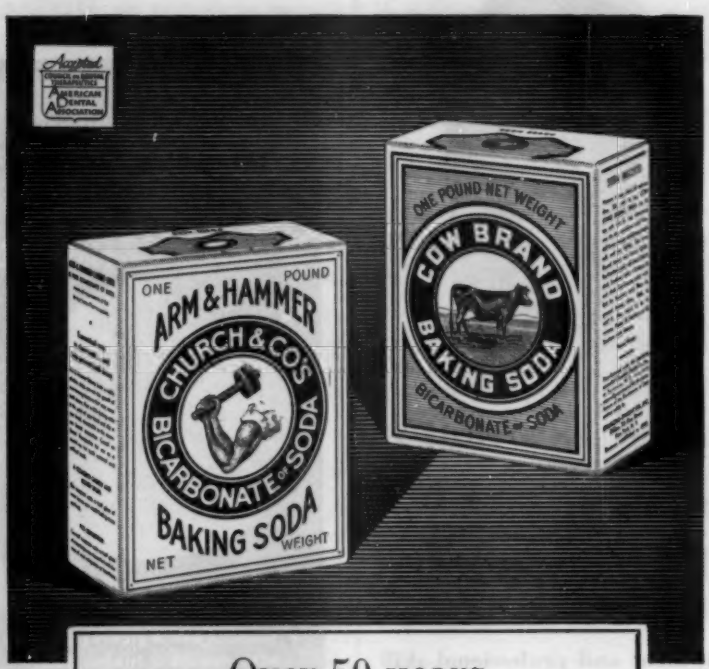

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1. Am. Dent. Assoc.: Diet and Dental Health. 1934, p. 8.
2. Thomas, A. E.: Oral Surg., Oral Med. & Oral Path. 7:741-749, 1954.

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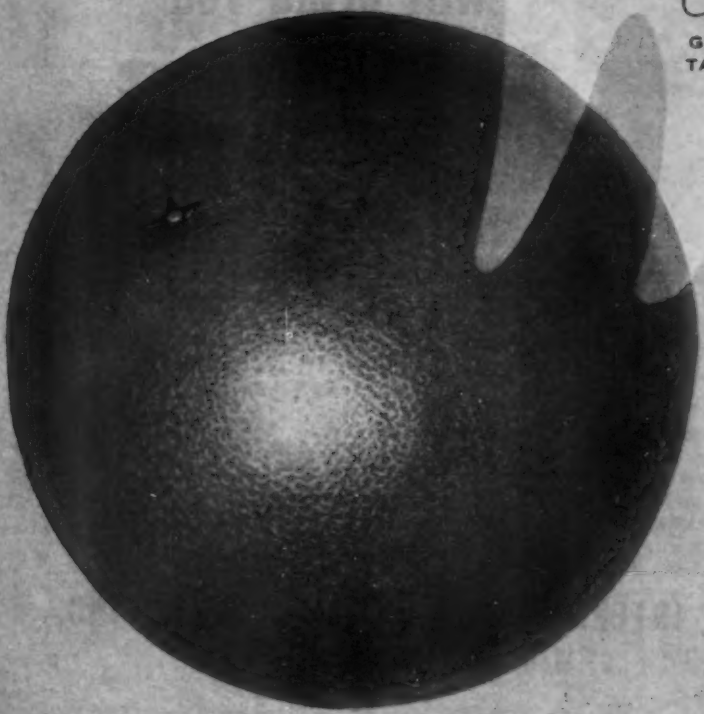

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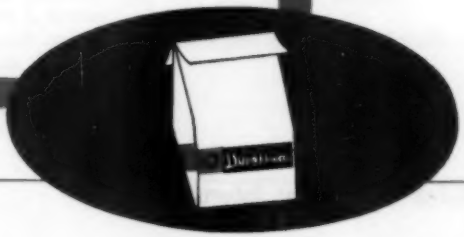

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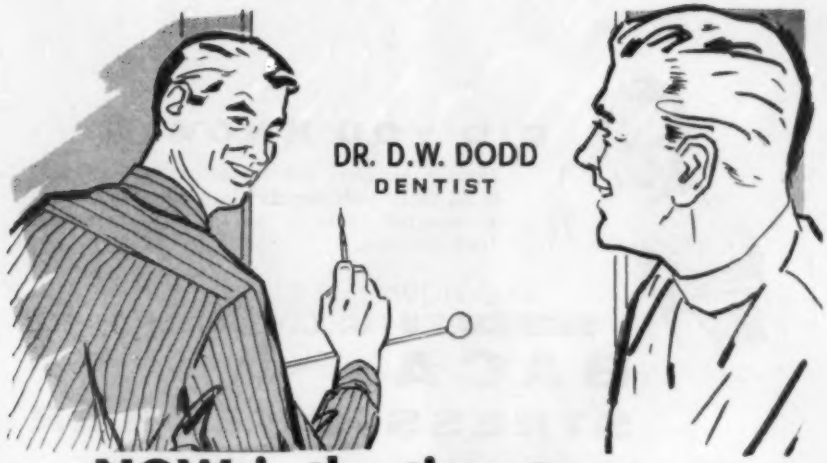

NOW is the time to join the A.D.A Group Plan

The A.D.A. group plan is designed to give members under age 50 outstanding life insurance value. Underwritten by Great-West Life, the plan offers maximum protection at minimum cost at a time when family responsibilities are heaviest and income is lower than it will be later on.

The plan provides **$5,000** Basic Life Insurance Protection or **$10,000** for Accidental Death at an annual premium of

$21.00 to age 30; $26.50 from ages 31-40; $42.00 from ages 41-50.

(After age 51 premium becomes 65.50 but does not increase thereafter. Instead, the amount of life insurance decreases annually from age 53.)

Conversion privileges and many additional advantages are available. For further details send coupon below.

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GREAT-WEST LIFE
ASSURANCE COMPANY
HEAD OFFICE - WINNIPEG, CANADA

OVER 13,000 A.D.A. MEMBERS NOW ENROLLED

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Please send me, without obligation, further details on the A.D.A. Group Life Plan.

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Address.....

Age.....

DID YOU KNOW...

Ticonium pioneered and introduced electro-polishing to the dental profession. The Ti-Lectro polisher is now an important factor in the polishing of sparkling Tru-Rugae cases.

AND NOW TICONIUM PROUDLY ANNOUNCES THE

BACA STRESS-CHECKER

The NEW Baca Stress-checker partials are precise, accurate cases. Use of a precision-made plastic former with a built-in fit gives accurate movement to every case.

You'll find the Baca Stress-checkers are easy to adjust for short bite cases. They have a very desirable posterior movement. Baca Stress-checkers have been in use for over five years in hundreds of practical applications. They are the most modern, up-to-date stress-checker available today.

Your Ticonium laboratory can now offer you Baca Stress-checkers. Another famous first by Ticonium.

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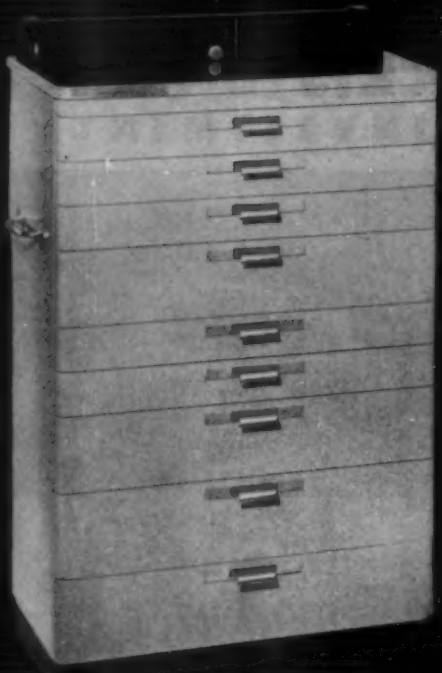
TICONIUM #25
IS BEST FOR SURGERY

Most Beautiful Most Efficient

OF ALL DENTAL CABINETS



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STEEL DRAWERS
Heavy gauge. Never sag. Never stick. "Floating" action.

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Drawers "float" on nylon wheels with steel ball bearings.

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★ *No measuring... No weighing... just add water!*

★ *A PRECISION FIT Every Time!*

A cristobalite-content investment used with an ultra-simple thermal expansion technic.

One mix for every type of inlay! Premeasured for correct mix—no weighing . . . no waste! Hermetically sealed until opened for use. No hydration... no contamination.

Each box contains 24 hermetically-sealed envelopes of 50 grams each, a 16 cc. water measure, asbestos ring liners, and a detailed, illustrated technic chart.

Try CRISTO-PAK!

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Here's a "money-back guarantee" way of trying CRISTO-PAK on your most difficult type of casting—with no risk on your part.

BUY A 2-BOX "PROOF-PACKAGE"... at special price $7.00

... TRY ONE BOX ... IF for any reason dissatisfied,

RETURN to Dealer one unopened box and GET FULL REFUND for cost of 2 boxes.

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FOR SYSTEMIC CONTROL OF ORAL INFECTIONS

Oral BICILLIN is a durable form of penicillin with special advantages for dental practice. Just one 200,000-unit tablet three times daily promotes *effective* control over a wide range of infections and complications. In both prophylaxis and adjunctive treatment, Oral BICILLIN offers prolonged antibacterial blood levels, resistance to gastric destruction, maximal safety, convenient dosage regimen.

PRESCRIPTION PADS ON REQUEST

Supplied: Vials of 36 tablets, 200,000 units per tablet. Also available: Suspension BICILLIN, 300,000 units per 5-cc. teaspoonful, bottles of 2 fl. oz.

Accepted COUNCIL on DENTAL THERAPEUTICS AMERICAN DENTAL ASSOCIATION

TABLETS SUSPENSION

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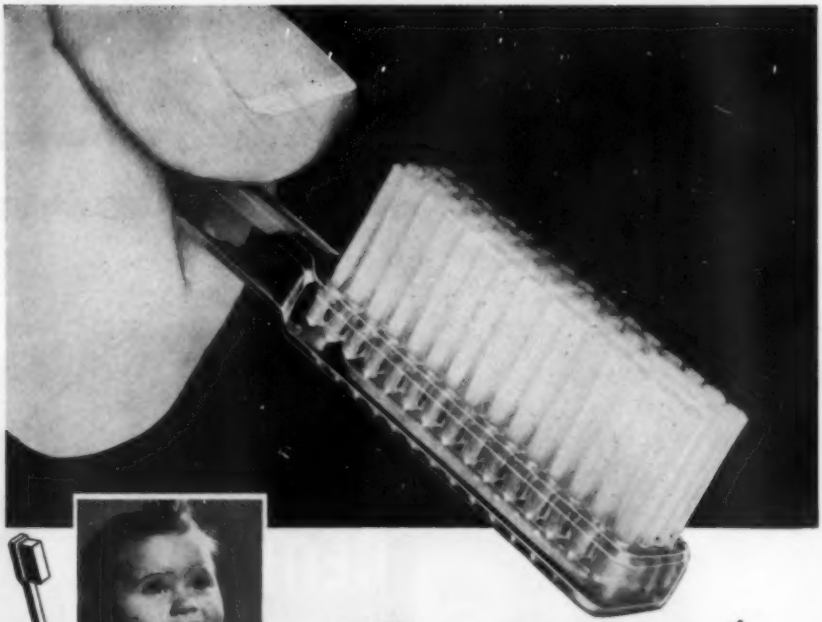
Wyeth® Philadelphia 2, Pa.

Penicillin with a Surety Factor

Jectron—the pre-cured **polystyrene** denture resin—is injected into a closed mold in a series of layers, which yields a **laminated** denture. That's why **Jectron** dentures are **strongest,** i.e., highest **transverse** strength, longest **flexure-fatigue** life, greatest **shock** resistance.

Only Jectron, with its superior strength, unchallenged processing accuracy and positive stability of form, gives you the properties necessary to achieve lasting retention and oral health. For complete details on the most modern of denture materials, send for new booklet, "Jectron—key to a more successful denture service." For your free copy, just write "service" on your card or letterhead and send to Jectron Company, 1009 Jackson Street, Toledo 1, Ohio.



Oral B 30

Oral B 40

Oral B 60

When a patient asks about a toothbrush...

In addition to adequate professional care, a simple suggestion, such as changing to the *right* toothbrush, often helps patients with serious gum disorders.

Reports from professional men also indicate that the right brush is equally important as an effective preventive measure.

An Oral B can be prescribed for this purpose because the 2500 softer, smaller, smooth-top filaments are designed to be gentle as well as effective. These features make it possible to clean teeth without abrasion and massage tender gingival tissues without injury. Your patients will appreciate the Oral B because it's both *safe* and *pleasant* to use.

Convenient prescription pads have been prepared for your use. Send for a supply today.

Oral B®
TOOTHBRUSH

ORAL B COMPANY
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the *Perfected* zinc oxide
quick setting, strong

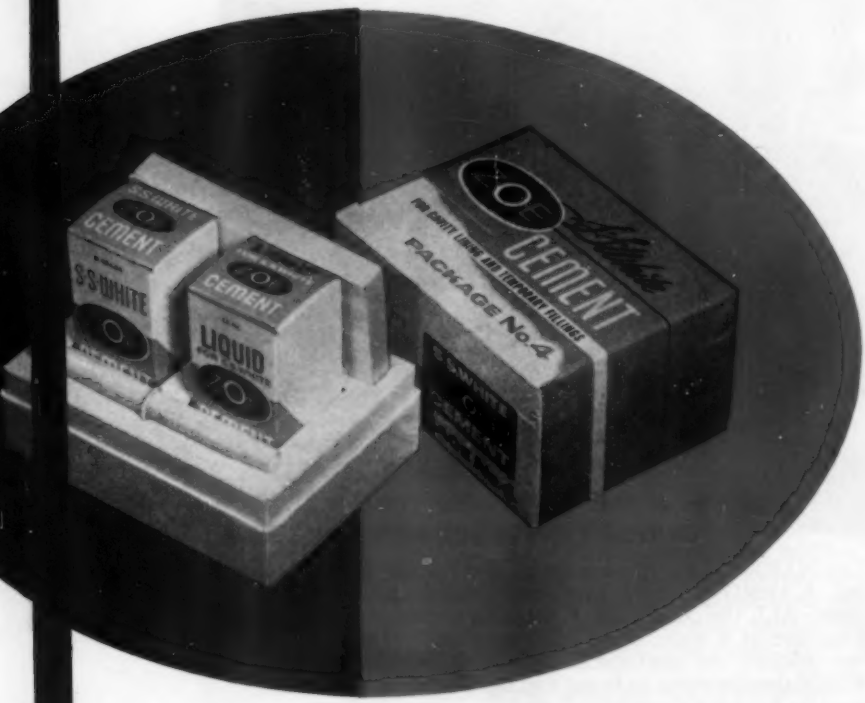
S.S.WHITE
Z·O·E
CEMENT

Z.O.E. Cement sets in 6 to 8 minutes. Setting time does not change with age! Used for cavity linings, filling can follow immediately. It also makes an excellent, temporary filling. Z.O.E. is good, too, for dressing seal. This improved Zinc Oxide Eugenol preparation spatulates readily, does not cling to dampened cotton pellets, and adheres firmly to cavity walls. After setting, it cuts cleanly. It is easy to remove and has a soothing effect on pulp. Ideal for lining posterior and anterior cavities except under acrylic fillings. You will like the superior results you obtain with Z.O.E.

THE S. S. WHITE DENTAL MFG. CO.

eugenol cement for cavity lining

enough for temporary fillings



This compact Z.O.E. Package No. 4 contains powder, liquid, mixing pad and powder measure. Price—$3.00

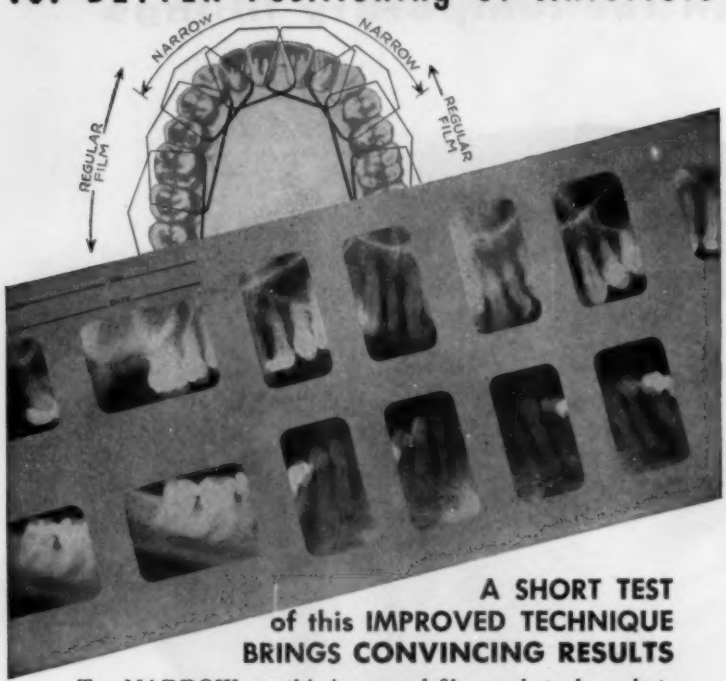
These items can be bought individually as follows:

Powder	$1.80 per bottle
Liquid	1.15 per bottle
Mixing Pads	.40 per pad

PHILADELPHIA 5, PA.

NEW RINN NARROW

for BETTER Positioning of Anteriors



A SHORT TEST of this IMPROVED TECHNIQUE BRINGS CONVINCING RESULTS

Try NARROW . . . this improved film packet places better. NARROW means finer radiographic results . . . it shows ALL the conditions. NARROW technique calls for 8 instead of 6 when doing full anteriors. . . . Use regular size packets for posteriors. NARROW is another fine RINN development to bring you better radiographs.

Two undistorted teeth on one film.

Use it for all interproximals and teen age junior periapicals.

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Write for full details and samples; please specify speed.

RINN **X-RAY PRODUCTS Inc.**
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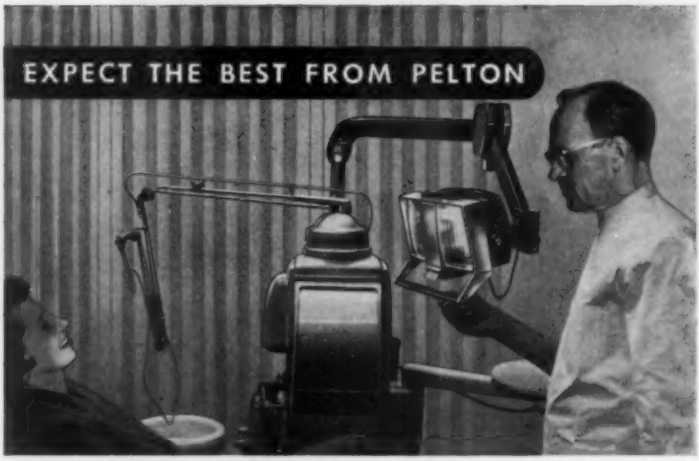
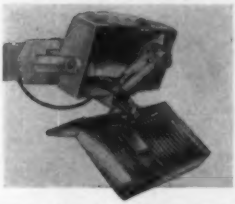


Perfect Oral Illumination



EASY TO SERVICE

By releasing latch at the top of the head, the front lowers and the heat-absorbing cylinder enclosing the bulb tips forward for easy removal of the bulb when necessary.

In the new Pelton Light you get the finest oral illumination made available by modern science. But that's not all. You also get a new styling that blends with the larger and sturdier equipment used in today's modern office. Styled for beauty, the Pelton is also styled for service. No other light has such finger-tip maneuverability, adjusts so easily for flooding the patient's mouth with cool, color-corrected light in any position or level of the chair. And the Pelton is built for long life. For example, its Radiant bulb outlasts any other bulb, even when projected vertically for a long time. See Pelton before you buy.

See the Pelton at your dealer's or write for brochure

Professional Equipment Since 1900

PELTON

THE PELTON & CRANE CO. • DETROIT 2, MICHIGAN

Who wants wide interproximal spaces where they serve no purpose ?

Designed specifically as BRIDGE TEETH, Steele's New Hue teeth *minimize* the interproximal space.

And equally as important as their improved anatomy, are their *functional* character markings — which when wet become tiny, light-reflecting *facets,* giving the tooth a true life-like *sparkle.*

Steele's New Hue facings and Trupontics are the *modern* teeth for all restorations of metal.

Steele's INTERCHANGEABLE TEETH

IN NEW HUE SHADES

The Columbus Dental Manufacturing Company • Columbus 6, Ohio

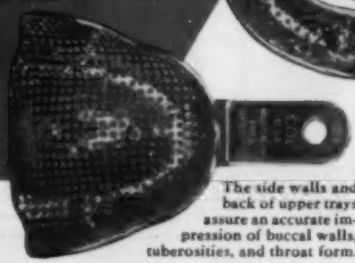
Here's Why

McGOWAN FULL DENTURE TRAYS *are for you*

NEW ***Developed for the most popular denture techniques:*** **Muco-Static, Micro-Denture, and McGrane and designed after close study of thousands of models, the 9-Tray set satisfies more than 90% of ALL case requirements—even eliminating the need for custom-made trays. The set consists of 3 upper trays: large, medium, and small; 6 lowers, 4 for the conventional lower ridge and 2 with shallow lingual and labial walls for the senile or so-called ridgeless mouth type. For better impressions in less time and more comfort to patients, use McGowan Trays.**

1. For Muco-Static, Micro-Denture, and McGrane Techniques
2. Satisfies more than 90% of all cases
3. Correctly shaped to carry alginate materials to all areas
4. Assures detailed accuracy
5. Saves considerable time

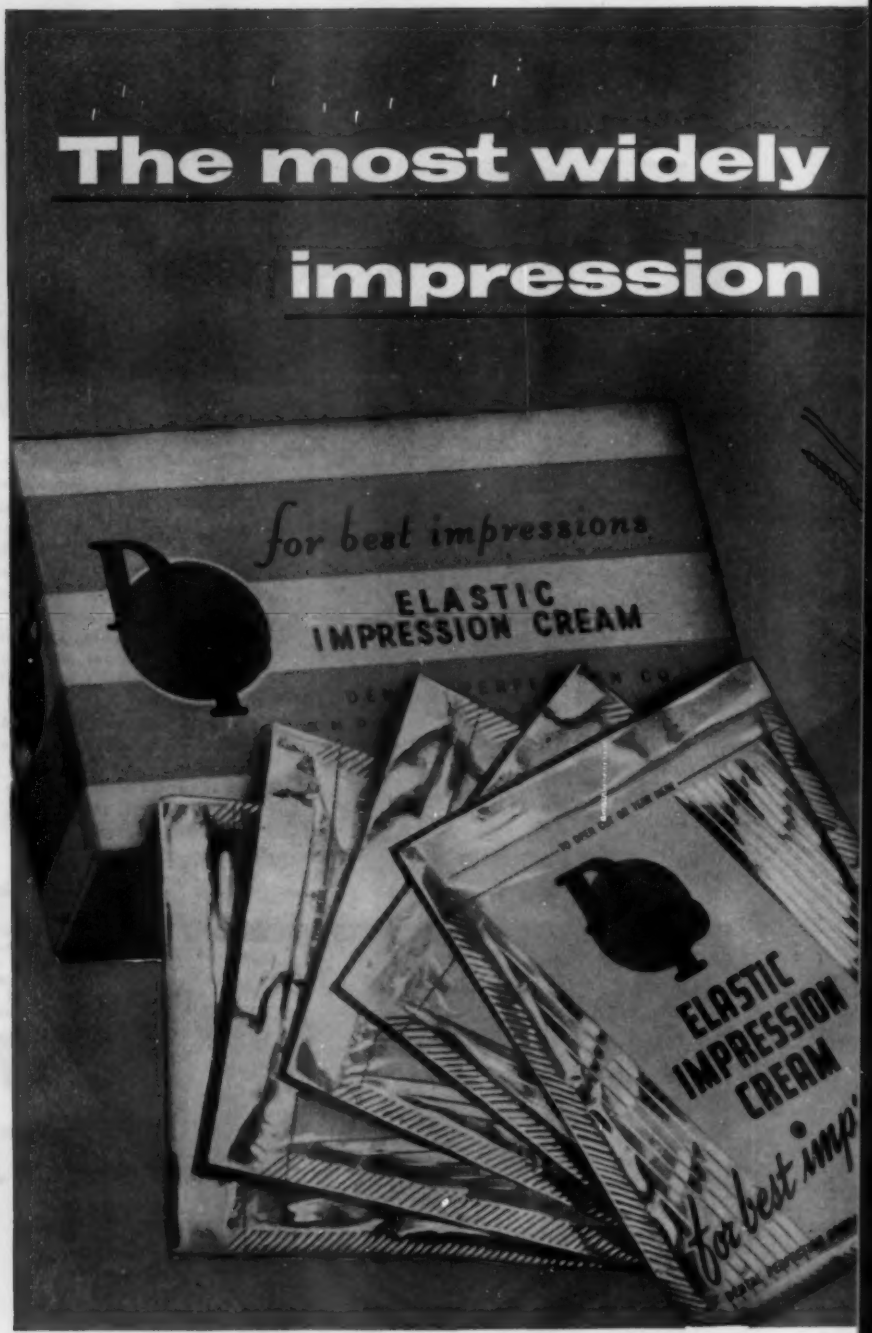
The flanges and back of lower trays assure an accurate impression of retromolar pads and sublingual fossa areas.



The side walls and back of upper trays assure an accurate impression of buccal walls, tuberosities, and throat form.

Order from your dealer

COE LABORATORIES, INC.
CHICAGO 21, ILL.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for best impressions
ELASTIC
IMPRESSION CREAM
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imitated material in dentistry...

. . . always did, and always will, guarantee you:

Uniformity . . . accuracy . . . creamy consistency . . . firm body . . . extreme elasticity . . . hard surfaced casts . . . no fixing solution.

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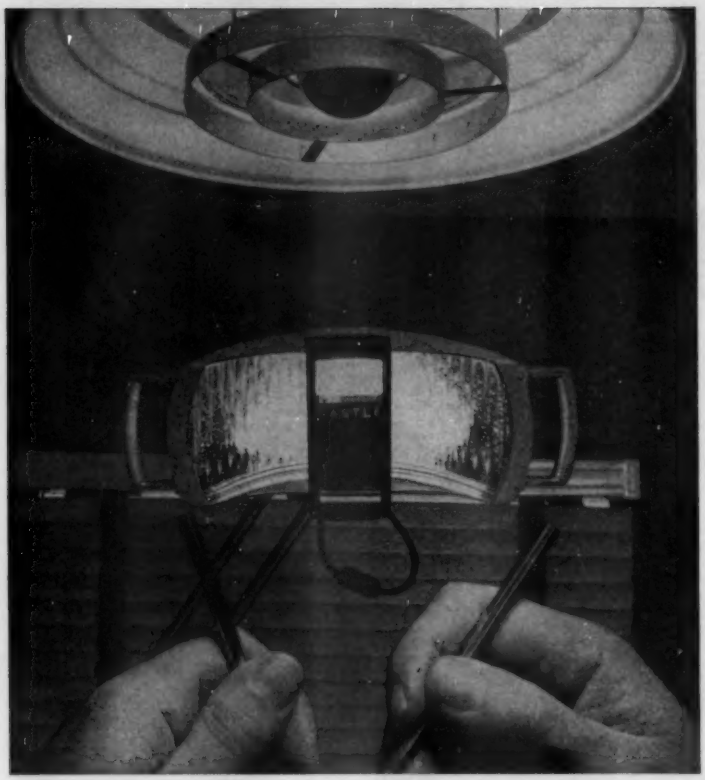


What does your patient see from the chair?

If the patient sees this pair of lights, she may be aware of their good design...

But—she has no way of knowing these lights mean as much to her own dental health as to your own comfort.

These lights—the Castle PV and GV—are a *matched pair* that help make your work more efficient—by making your day less tiring.

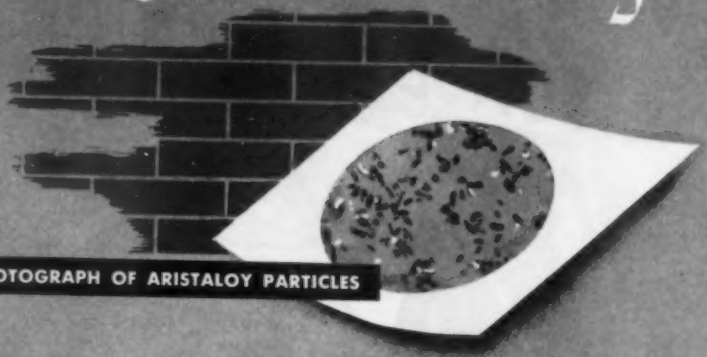
Multi-beam PanoVision lamp illuminates oral cavity with diffuse, glareless light. And, directly over the patient, Castle's General-Vision Light illuminates office and work area.

This *balanced lighting* keeps contrasts low, reduces eye-strain and fatigue... makes your work easier. To see how, phone your Castle dealer, or write:

Castle LIGHTS AND STERILIZERS

WILMOT CASTLE CO. • 1104 UNIVERSITY AVE. • ROCHESTER 7, N.Y.

THERE IS ONLY ONE Aristaloy



A MICROPHOTOGRAPH OF ARISTALOY PARTICLES

SOLID, VOID-FREE STRUCTURE: Finely cut Aristaloy particles are solid "bricks" of selected shapes that pack into such close proximity to one another and to the cavity wall that a uniform cementing medium is quickly established. Mercury penetrates only the surface of the clean particles, causing a *chemical formation of intermetallic bonding compounds.*

Coarsely cut particles or irregular shaped "bricks" never can be packed close together. If broken down in trituration, they go into dust and uncontrolled shapes. Mercury is trapped in spaces between such particles. Compounds continue to form causing excessive expansion. In many cases galvanic action will etch or erode the surfaces of the finished filling.

Dense, Aristaloy amalgam fillings stay bright and clean under all oral conditions and assure *permanently sealed cavities.* Many thousands of Dentists, most colleges and research workers have proven these facts, conclusively. ★ ★ ★ ★ ★ ★

You pay no premium for Aristaloy quality. It is definitely not sold under any other label and has not been even closely imitated.

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THE WORLD'S LARGEST WORKERS AND REFINERS OF PRECIOUS METALS

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has FORCEPS for every need!

ASH

DON'T BE MISLED . . . . insist on authentic ASH Forceps, not just a copy of a famous ASH pattern. Look for the name "ASH ENGLAND" on the handle or beak.

Claudius Ash, Sons & Co., U.S.A., Inc.

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the ability to repair . . .

Partials weren't made to be dropped or abused . . . but they are. Changes may become necessary. G-3 partials can be repaired, adjusted or modified easily, inexpensively *and safely* . . . another case of true gold economy, using the best there is, Ney-Oro G-3.

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CAULK CAVITY PRIMER

to make the cavity chemically receptive

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By flowing liquid against powder and tooth surfaces in successive layers, you have the virtual equivalent of no shrinkage!

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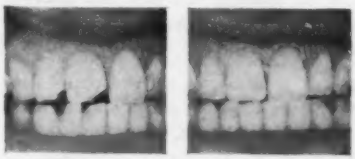

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Even under intense exposure to ultraviolet rays (per standard ASTM test) no color change is detectable by the unaided eye

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FOR MODERN MATERIALS CALL ON

CAULK Milford, Delaware

Astring-o-sol mouthwash

concentrated for economy and convenience

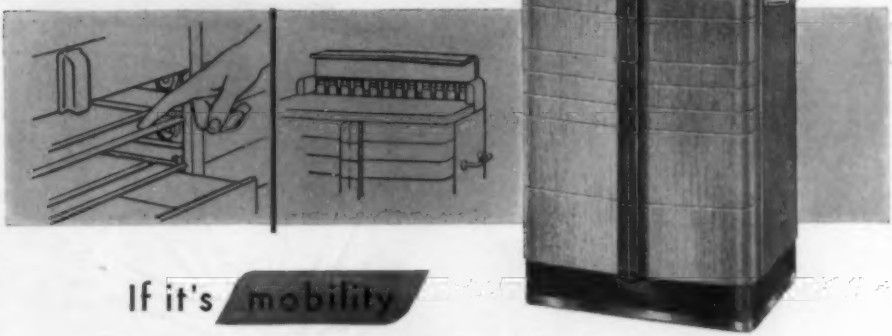
a little goes a long way

- Here is a peppy, invigorating mouth rinse that not only tastes good and sweetens the breath, but also helps loosen and flush away organic debris.
- Astring-o-sol is an efficient detergent and effective deodorant. It will not injure delicate oral tissues and is ideal for daily mouth care.
- It's economical . . . it takes only a few drops of concentrated Astring-o-sol in a half-glass of water for a pleasing and effective mouthwash.
- USE IT AT THE CHAIR BEFORE AND AFTER DENTAL PROCEDURES
- RECOMMEND IT TO YOUR PATIENTS FOR DAILY MOUTH CARE

Remember... it takes only drops instead of drams because it's concentrated.

American Ferment Co., Inc.
1450 Broadway, New York 18, N. Y.

Nine-drawer Model 180— compact efficient, mobile. Concealed medicine compartment, and dust covers on smooth-gliding drawers are typical of the many outstanding features in every American Cabinet.



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AMERICAN...by Hamilton

Consider your easier hours with a mobile American Cabinet . . . Seated, you draw the cabinet smoothly into any position. The medicine compartment opens at a touch. Glass trays hold instruments, clamps, discs, etc. at your fingertips in quietly opening drawers . . . Everything instantly at hand for maximum convenience and efficiency.

There are four variously sized mobile models, each outfitted to meet professional requirements, each in a choice of five handsome Colortone finishes. Your American Cabinet dealer can show you why these Hamilton-built cabinets out-sell every other; why not consult him today?

Hamilton
AMERICAN CABINETS

HAMILTON MANUFACTURING COMPANY

Two Rivers, Wisconsin

SANDBLAST A
WERNET'S DENTU-CREME AN

Ming Vase?

Priceless ancient pottery calls for careful cleaning, lest the beautiful surface finish be irreparably damaged. • Beautiful dentures, too, can be ruined by the careless use of inappropriate cleansing agents. You can help protect them by suggesting Wernet's Dentu-Creme and Wernet's Plate Brush. • Dentu-Creme is smooth, absolutely non-injurious, and an excellent detergent. The special polishing agent it contains makes it ideal for use on acrylics. • Wernet's Plate Brush, with the Easy Grip Handle, conforms to professional specifications. Its divided tufts of fine bristles are individually wired-in for long life. Its black bristle section is used on the ridge and the vault—its white bristle section on the teeth and interproximal surfaces. • For safe, yet thorough removal of mucin plaques, food particles and stubborn stains, suggest Wernet's Plate Brush and Wernet's Dentu-Creme.

WERNET DENTAL MFG. CO., INC.

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WERNET'S PLATE BRUSH

for
caries-active
patients
prescribe

Amurol

NON-CARIOGENIC

Sugarless Gum

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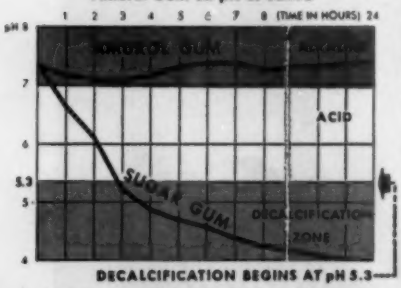
AMUROL PRODUCTS COMPANY
116 S. MICHIGAN AVE., CHICAGO 3, ILL.

Comparative Effects of Sugar Gum and Amurol Gum on pH of Saliva



DECALCIFICATION BEGINS AT pH 5.3

As shown above, pH of caries-active saliva remains in alkaline zone for hours with AMUROL SUGARLESS GUM, whereas with sugar gum the pH drops to the acid level under the same conditions.

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$4,250,000 Assets

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Omaha 2, Nebraska

a pin

may not lead to a denture repair

BUT...

IT'S EASY TO SAFEGUARD

DENTURES AGAINST REPAIRS

DUE TO PIN-LINE BREAKAGE

Micromold **PORCELAIN** *Teeth*

THEY HAVE NO PIN-LINE

Prescribe or obtain Micromold Porcelain Teeth through your Vitallium Laboratory

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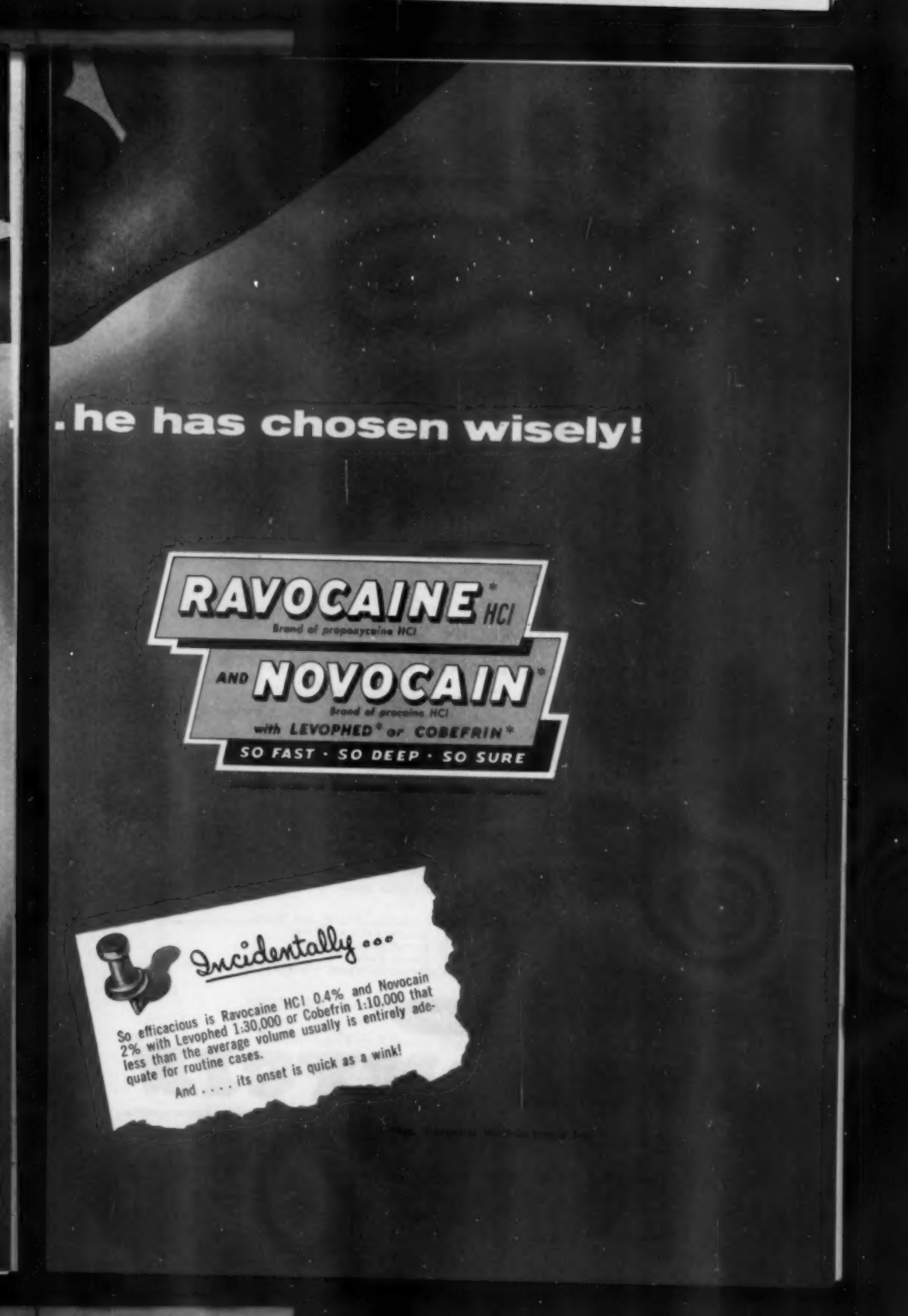
.he has chosen wisely!
RAVOCAINE* HCl
Brand of propoxycaine HCl
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SO FAST · SO DEEP · SO SURE
Incidentally ...
So efficacious is Ravocaine HCl 0.4% and Novocain 2% with Levophed 1:30,000 or Cobefrin 1:10,000 that less than the average volume usually is entirely adequate for routine cases.
And .... its onset is quick as a wink!

AUREOMYCIN Capsules

outdate antibiotic injections

Practically all patients prefer to take medicine orally rather than by injection. AUREOMYCIN Capsules provide the dentist with a potent antibiotic in this patient-accepted form.

They also offer three other important advantages: 1) true broad-spectrum antibiotic activity, 2) longer retention in body tissues and fluids, 3) lower cost, thus saving money for both dentist and patient.

AUREOMYCIN Capsules are indicated as an adjunct to accepted dental techniques in extractions and surgery, and in the treatment of gingivitis and Vincent's infection.

On your prescription, patients may secure AUREOMYCIN Capsules from any pharmacy. Available to you from your usual source of supply.

FREE For your convenience in prescribing AUREOMYCIN, Lederle has prepared special prescription pads. Write for yours today!

Capsules: 250, 100 and 50 mg.
Soluble Tablets: 50 mg.
Dental Cones: 5 mg.
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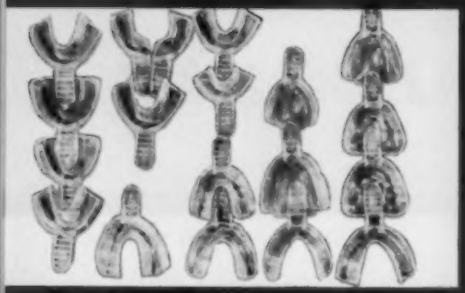

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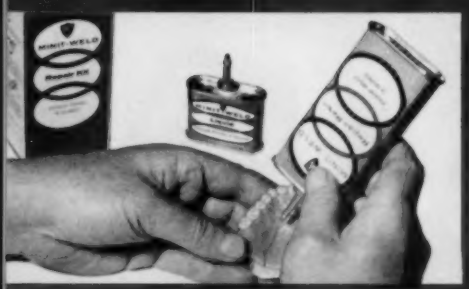

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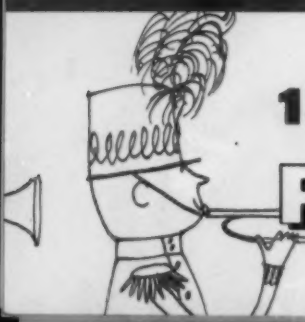

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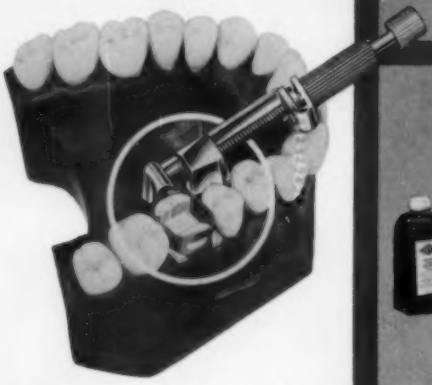

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